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NOVEMBER, 1952

APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

TEST STAND CONSTRUCTION 61

HOLLOW ROD CYLINDER DESIGN . . . 65

PACKAGED FEED REDUCES PIPING . . 69

BASIC APPROACH TO DESIGN PROBLEMS 74

AIR POWERED DRILLING 102

Listed on page 2 you'll find 12 articles and 7 regular departments which feature application and design ideas for fluid power equipment

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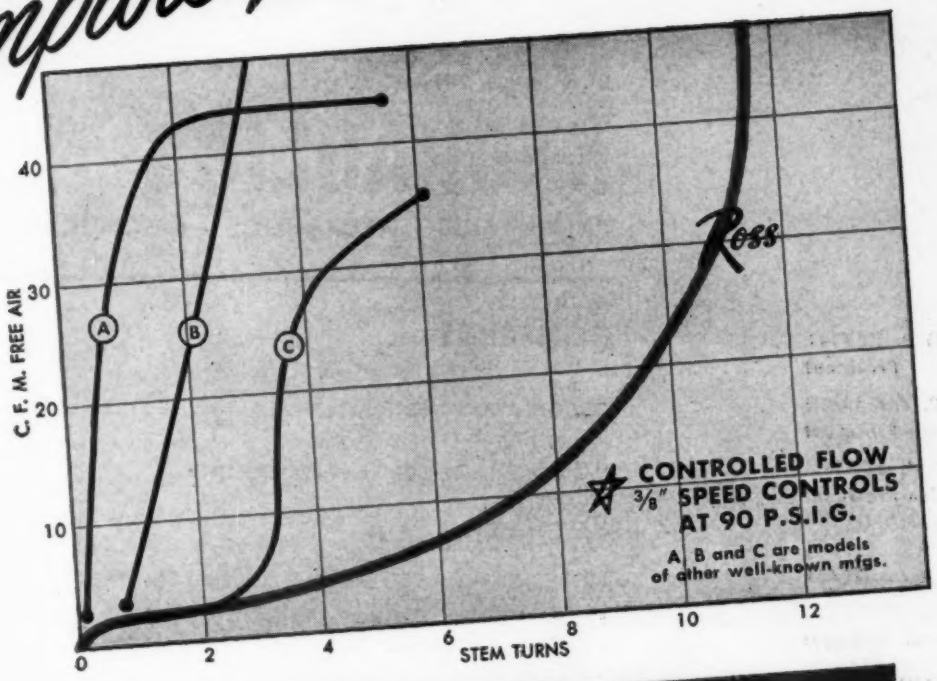

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NOVEMBER, 1952
Vol. 5, No. 11

APPLIED HYDRAULICS

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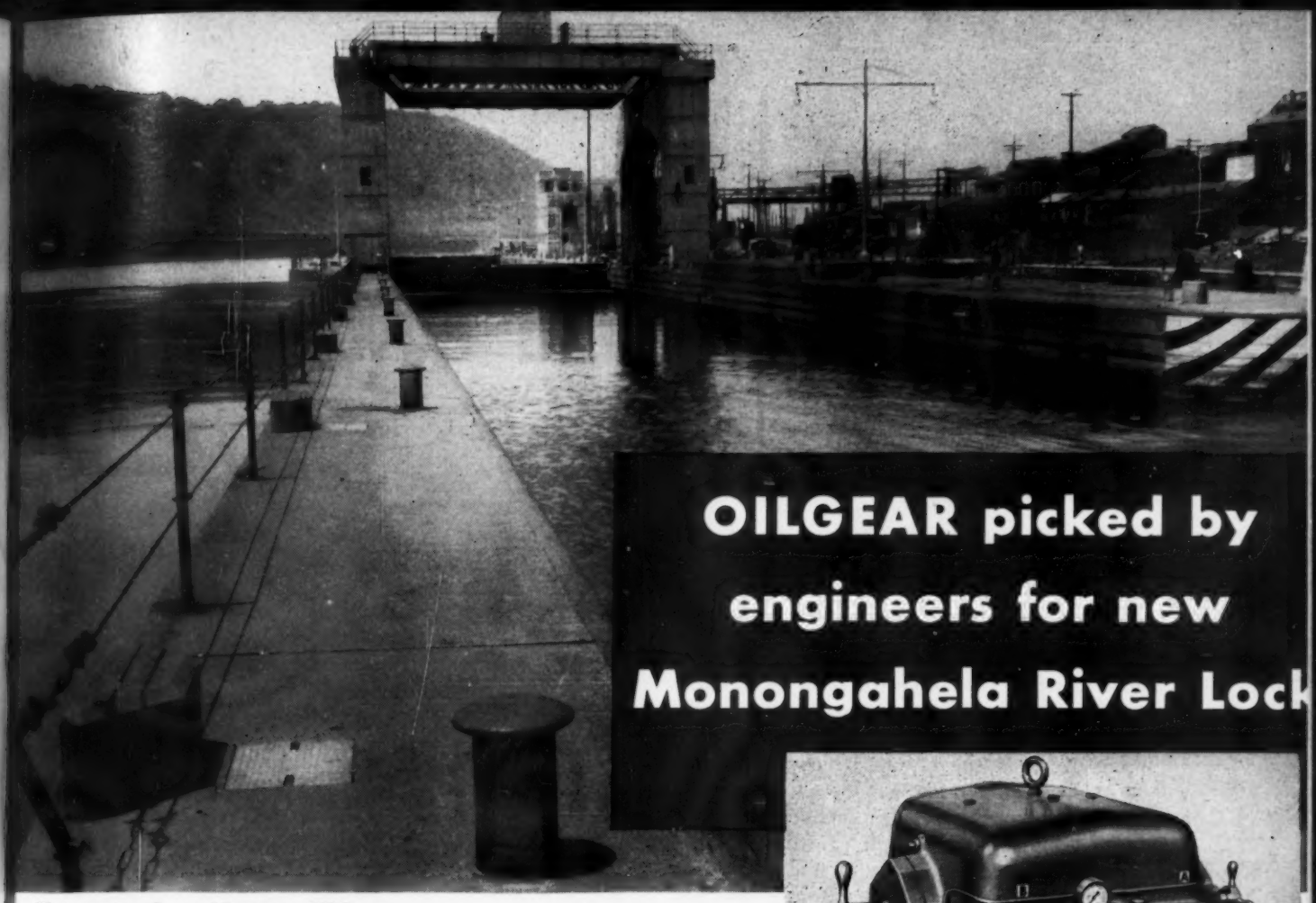

OILGEAR picked by engineers for new Monongahela River Lock

Photo courtesy Corps of Engineers, US Army

This versatile fluid power also used in McNary Dam and Bayou Boeuf Locks

The problem of selecting the power to operate the lock gates, butterfly valves and capstans in the new Monongahela River Lock was to provide the speed of operation, the capacity and the dependability that would keep the rapidly growing volume of shipping on the move. The river at this point now handles millions of tons more annually than Panama.

Certainly, in the fact that Oilgear Fluid Power equipment was selected for this lock, as well as for those at McNary Dam in Oregon, and at Bayou Boeuf in Louisiana, is evidence of the repute in which Oilgear is held.

But we are inclined to stress the *versatility* of Oilgear Fluid Power . . . its applicability to a wide range of needs ranging from the impressive capacity required for lock operation . . . to the delicate and assured precision, controllability and accuracy required in printing on flimsy cellophane . . . and to the middle ground of industry where production must always be increased and always kept on the move.

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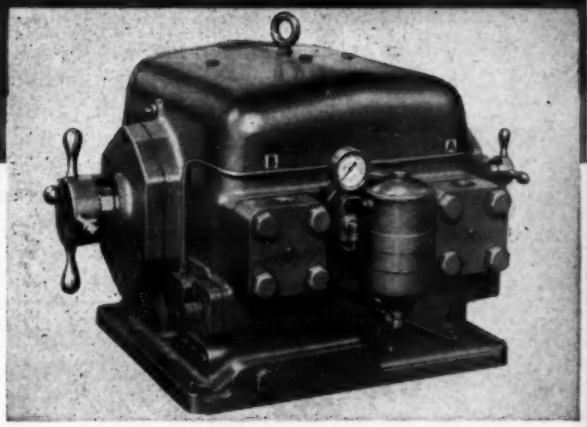

Oilgear Two-way Variable Delivery Pump with Electro-hydraulic Three-position Remote Control.

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APPLIED HYDRAULICS

Fluid Power Lines

N this issue, APPLIED HYDRAULICS announces the first Prize Paper Contest. This contest is open to all engineering and plant personnel except employees of manufacturers of components and their sales representatives.

We've prepared suggestions which along with an entry blank will be made available to you. Seven cash prizes totalling $1200 are offered for papers on design, application or maintenance of hydraulic or pneumatic equipment.

There is also a special group of student prizes offered for papers prepared by undergraduate and graduate students. It is our hope that the student prizes will help to give the student engineer a better understanding of the possibilities offered in industrial hydraulics and pneumatics.

Cylinder Designs

D. C. Thomas, of TEC Engineering Corp., describes an interesting production press in his article this month. Their force application problem was solved with a cylinder within a cylinder to provide double action along the same center line.

Equipment for Development

What equipment do your design engineers have to help them develop better products? Is your development lab equipped to give all the necessary tests to assure a better product?

There are two valuable articles this month describing in detail succesful test equipment which can be readily applied to assist in both the devolpment of new equipment and in maintaining quality control on present production.

R. E. Sanders of Bendix Products Division, details the design of a hydraulic test stand which is used for flow tests, leakage and pressure tests and life cycling tests. Using drawings and photographs the construction of this test stand is completely detailed. It is built to provide sufficient capacity and pressure ranges and is flexible enough to handle a variety of work.

The second article, written by Dean J. Madsen of Northrop Aircraft, describes a laboratory test setup for maintaining loads on aircraft structural members. A hydraulic servo system working with a deflecting dynamometer accurately maintains the load for a preset deflection.

Friction Losses

In this month's Beginners' Course in Basic Pneumatics section, you'll find tables and procedures which will assist you in determining friction losses in air systems. It has been common practice to convert a given valve to equivalent pipe length. This has to be a guess for most valves. As we prepared this section, we found that several valve manufacturers are helping to take some of the guesswork out of this friction problem. They have run friction tests on their valves and give the user the orifice size which will give the same pressure drop as the valve. More of this kind of data is needed to help create efficient fluid power systems.

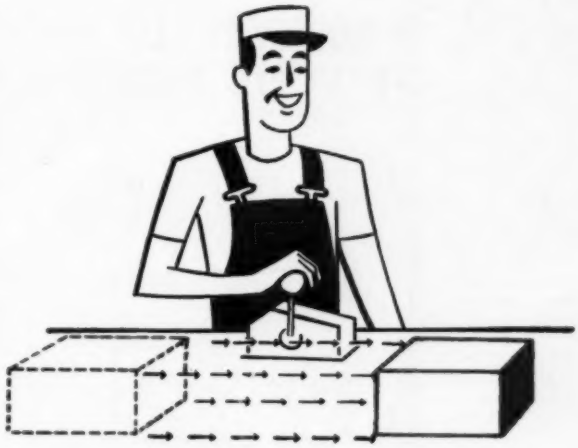
Solving Problems

Both Elmer Heiser and Charlie Hallet, who are sales engineers with S. G. Morris in Cleveland, have had many years experience in working out pneumatic and hydraulic circuits with their customers. Last year, when we were "chairmaning" several sessions on hydraulics at the Cleveland Engineering Society, Elmer and Charlie accepted our invitation to discuss their approach to circiut problems. They provided such an interesting evening for the fifty men from Cleveland industry, that we asked them to prepare an article for APPLIED HYDRAULICS.

In their article "A Basic Approach to Hydraulic and Pneumatic Design Problems", Mr. Heiser and Mr. Hallet first point out the fixed requirements and then emphasize the variable conditions which influence selection of components and machine layout. They present a flexible approach to any problem, not a rigid pattern of solution which would be impossible to maintain. This approach to a problem will assist the designer in carefully analyzing his proposals.

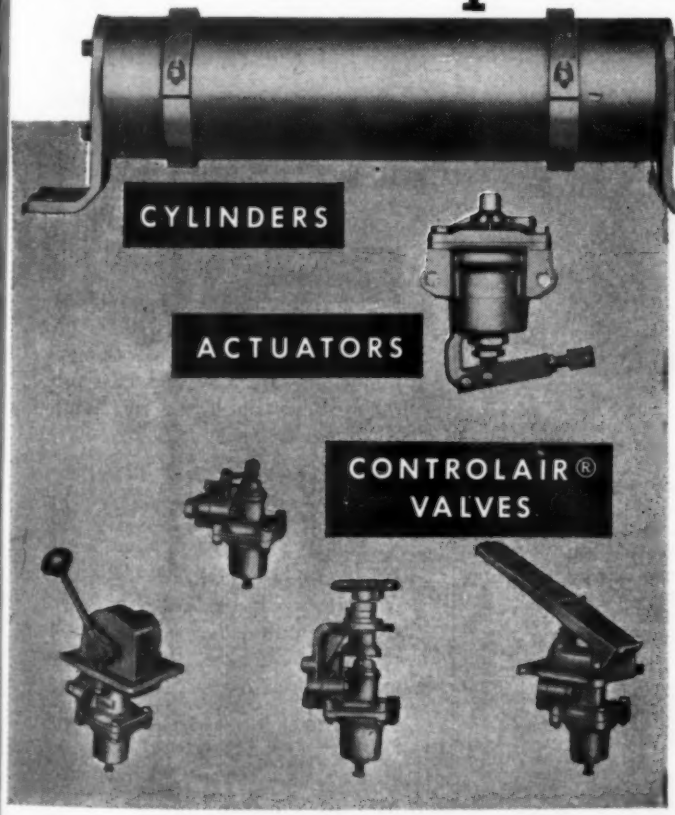
want to clamp something

...or position it?



use these

low cost pneumatic muscles



It's hard to find a machine that doesn't require powerful, linear motion in some part of its operation. Clutches must be engaged, objects must be grasped and held fast, heavy loads have to be moved in a straight line.

Air is the answer. Pneumatic cylinders exert powerful, cushioned force for any holding operation. Pneumatic actuators allow hair-splitting accuracy if you want to position something exactly. In addition, you have your choice between a very wide range of air controls that permit the most complex interconnected assemblies.

But the best part is this: you can buy everything, the cylinders, actuators, control valves *and* the compressor from one company, Westinghouse Air Brake Company, world leader in engineered pneumatic control systems.

There's a Westinghouse Air Brake Company distributor near you; just look in your Classified Directory under "Air Compressors." He'll be glad to show you how Westinghouse components can help you engineer a better product.

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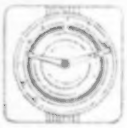

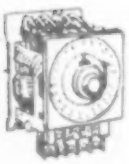

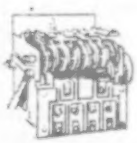

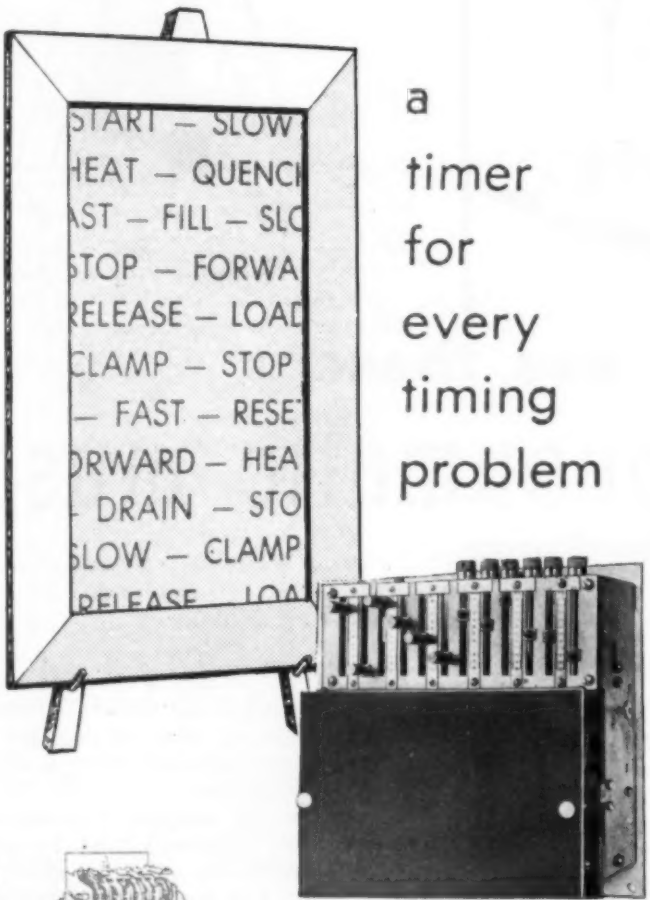

a timer for every timing problem

MULTIFLEX Bulletin 130

Multiple Circuit Reset Timer, may have from 1 to 6 independent circuits each of which is electrically independent of the other and may operate on independent cycles except for maximum duration. Units may be cascaded, available with or without vernier adjusting members.

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LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

For more information circle numbers on the reader service card bound in this issue.

LIMIT SWITCHES, built in a variety of types and sizes to suit every industrial application, are described in engineering bulletin EM-51, offered by the National Acme Company. Also available is Bulletin EM-52, describing welded solenoids.

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WIDE TEMPERATURE RANGE can be covered by selecting the proper O-ring material. Plastic and Rubber Products Company offer catalog and engineering data to help avoid premature seal failures.

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TIME DELAY SWITCHES for air or hydraulically operated machine movements, are detailed in literature available from Pneu-Trol Devices, Inc.

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SYNTHETIC RUBBER RINGS AND SEALS, custom engineered for many applications, are covered in a rubber handbook published by Acushnet Process Company.

Circle 2 on Reader Service Card

WATER BASE HYDRAULIC FLUID is described in a comprehensive booklet 'Ucon Hydrolubes' published by Carbide and Carbon Chemicals Co.

Circle 18 on Reader Service Card

AIR MOTOR, a complete air cylinder power unit, is described in a new 30-page booklet prepared by The Bellows Company. The features of the air motor, which is equipped with the Electroaire valve, are fully discussed.

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INDUSTRIAL OIL which gives superior protection for a wide variety of industrial equipment, has been described in a booklet offered by the Standard Oil Company.

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HYDRAULIC TEST EQUIPMENT, fully automatic and portable for site testing, is illustrated in a brochure offered by Davies Brothers. Detailed are a range of 34 models, single and double acting for rapid testing of valves, pressure vessels, pipes and fittings.

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PISTON TYPE PUMPS, adjustable to an infinite variety of loads and speeds, have been outlined in Bulletin 2-P, available from Blackhawk Manufacturing Company.

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AXIAL PISTON PUMPS for high pressure applications, featuring space saving designs with a choice of face, flange and foot mountings, are described in Bulletins issued by the Denison Engineering Co.

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PACKINGS, which help reduce production and maintenance costs of hydraulic equipment, are listed with complete engineering data in literature available from Chicago Rawhide Manufacturing Company.

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ROTARY GEARED PUMPS with helical gears and roller bearings are featured in a catalog offered by Brown & Sharpe.

Circle 15 on Reader Service Card

AERO HYDRAULIC SWIVEL JOINTS are detailed in Catalog 2A, issued by the Chiksan Co. Swivel joints are available for all aircraft applications handling hydraulic oil, fuels, water, air, oxygen and other fluids.

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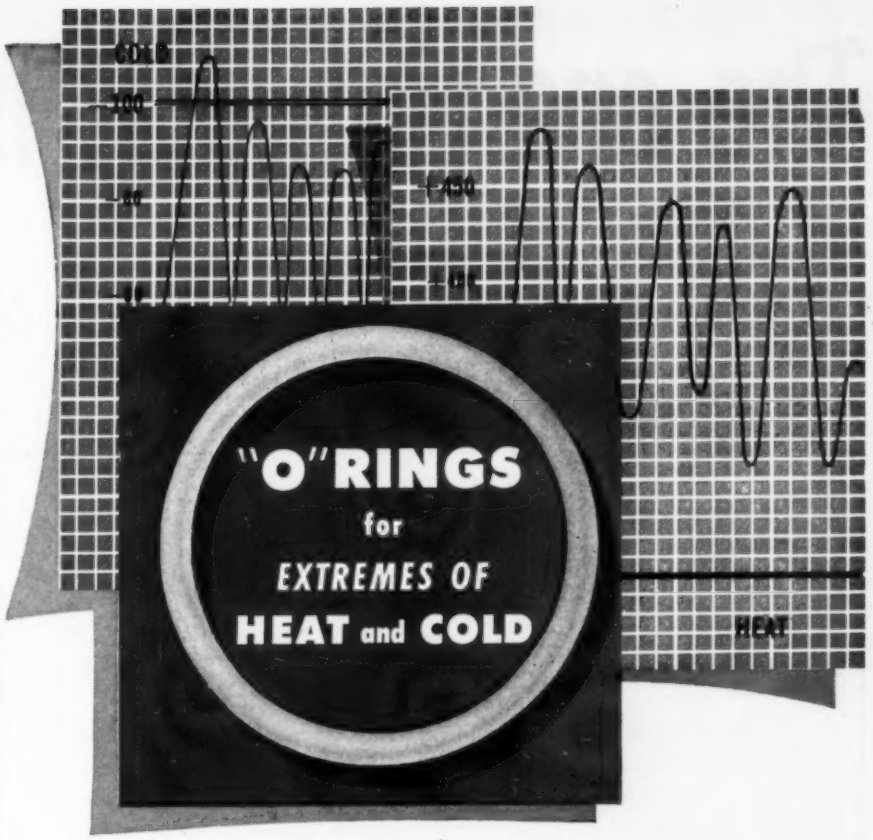
Continued on page 25



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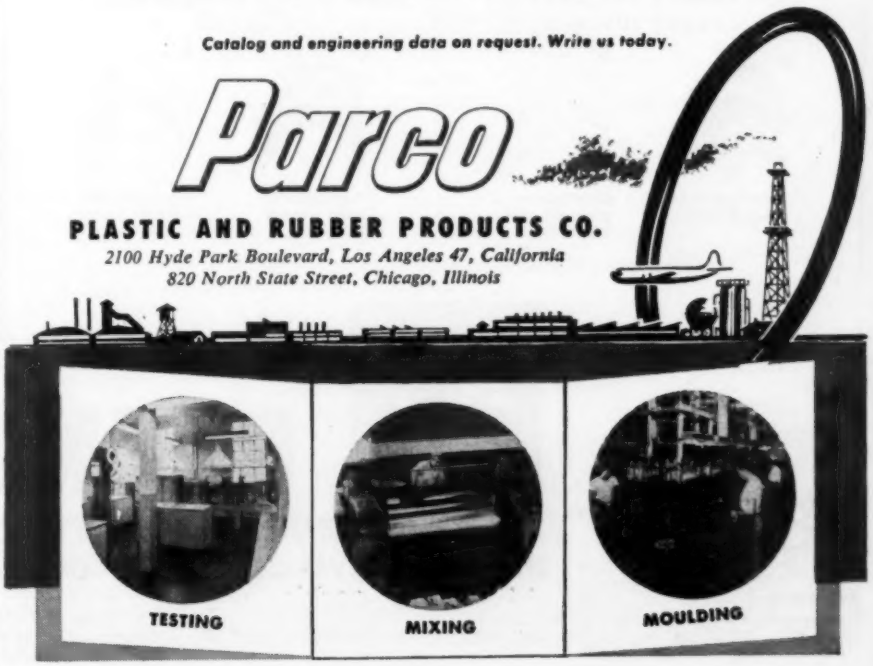

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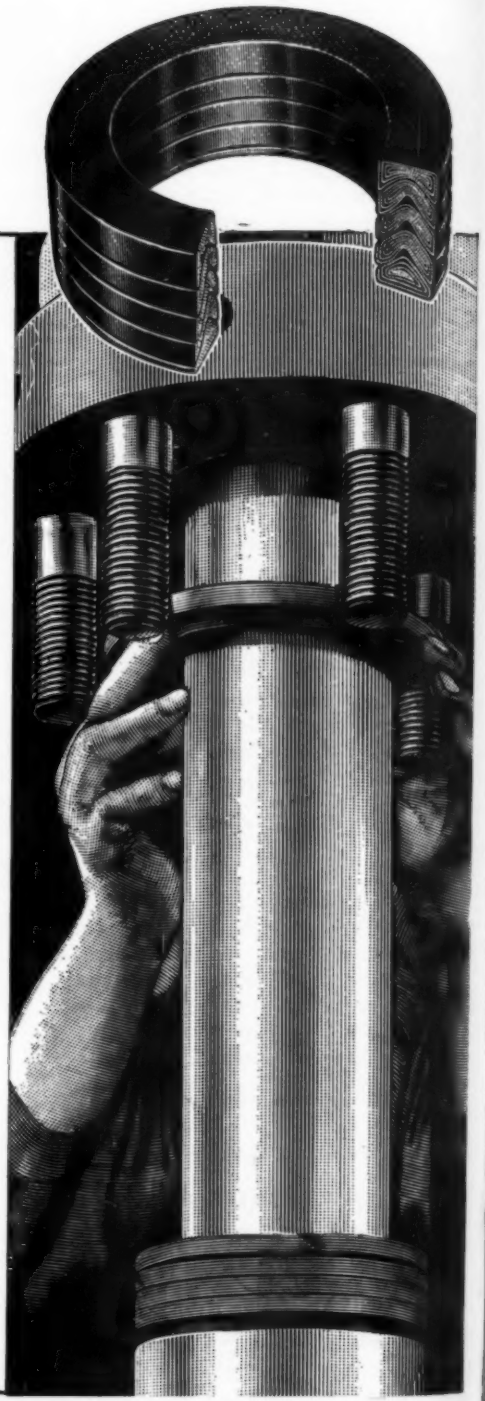
The one ring that is different

THE R/M VEE-FLEX® PACKING RING HAS UNIQUE DESIGN THAT INSURES AUTOMATIC SEALING



R/M Vee-Flex Packing Rings are being used in increasing numbers of hydraulic cylinders, rams, presses, lifts, pumps, valves and other equipment. They are used, for example, on the world's largest testing machine at the Naval Air Material Center, Philadelphia.

The efficiency of the Vee-Flex Ring is due largely to the unique convexly curved surfaces. Recently, Raybestos-Manhattan sponsored a series of photoelastic stress analyses* and radial pressure tests* on packing ring designs. Photoelastic fringe patterns showed that R/M Vee-Flex design distributes pressure horizontally against the stuffing box wall and shaft . . . as well as vertically against the next ring. These conclusions were corroborated by the radial pressure tests, in which maximum sealing was obtained at a point slightly below mid-width on the sealing area.

Vee-Flex Rings are made in a great variety of sizes up to 60″ in diameter and for annular spaces from ¼″ to 1½″. Different materials are provided for service against water, petroleum products, steam, vegetable oils, air, milk and other beverages; and for pressures up to 6000 p.s.i. and higher.

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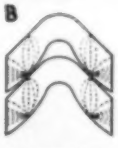
R/M RINGS WITH CONVEXLY CURVED SURFACES

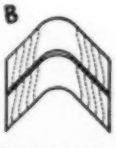
A — Photoelastic fringe patterns.



B — Simplified diagram of stress trajectories.

RINGS WITH FLAT CONTACT SURFACES

A — Photoelastic fringe patterns.



B — Simplified diagram of stress trajectories.

Performed at The Franklin Institute Laboratories for Research and Development

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EXCHANGERS to assure operating temperatures for all types of hydraulically operated machines, are outlined in Bulletin 1.1K5 available from Kewanee-Ross Corporation.

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LEATHER PACKINGS with greater wear resistance, tighter sealing, better high and low temperature stability, are covered in Engineering Handbook and technical literature published by C. W. Marsh Co.

Circle 73 on Reader Service Card

OIL PURIFIER to help prevent trouble in hydraulic installations, by keeping oil clean and free from damaging contamination, is described in a bulletin offered by Honan-Crane Corporation.

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STAINLESS STEEL FITTINGS, which provide corrosion-resistant, pressure-proof hydraulic connections are outlined in Ermeto Catalog E-1457, issued by The Weatherhead Co.

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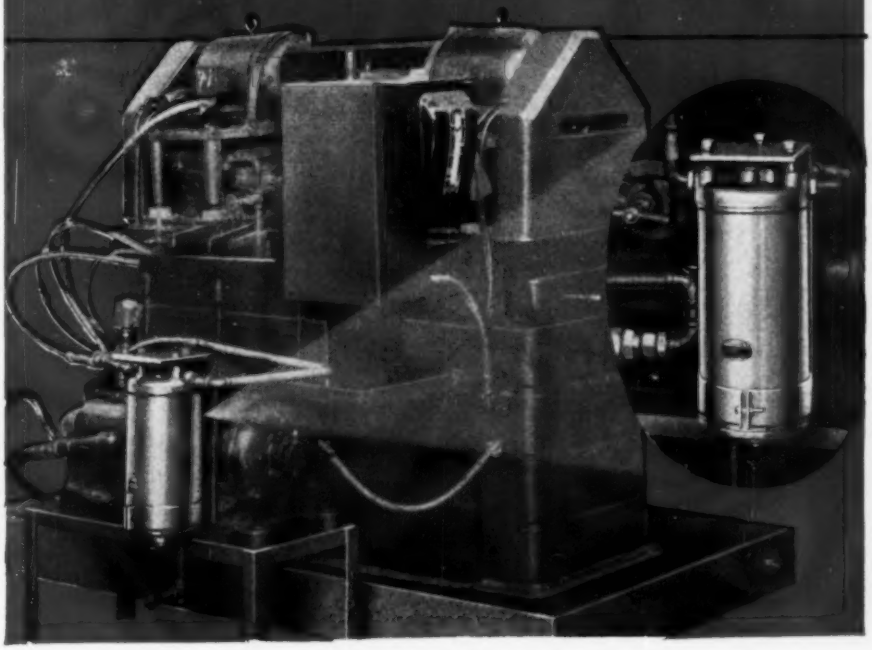
NOVI EQUIPMENT CO. CHOOSES GENERAL FILTERS

. . . for Low Cost Protection of their Hydraulic Systems



As protection for the all-important hydraulic control units on their EX-CELL-O Grinders Novi Equipment Co., of Novi, Mich., relies on the GENERAL AF-500 FILTER. The AF-500's positive absorption seals off hydraulic and lubricating system impurities from highly machined vital parts, removes moisture, eliminates the necessity of draining and refilling oil systems for as long as a year. Clean, safe oils are assured at 15-20 gallons per minute, depending upon viscosity. This trend toward GENERAL is industry-wide. Both on new and old equipment, General Industrial Filters reduce maintenance costs and offer the longer machine life required by current production schedules.

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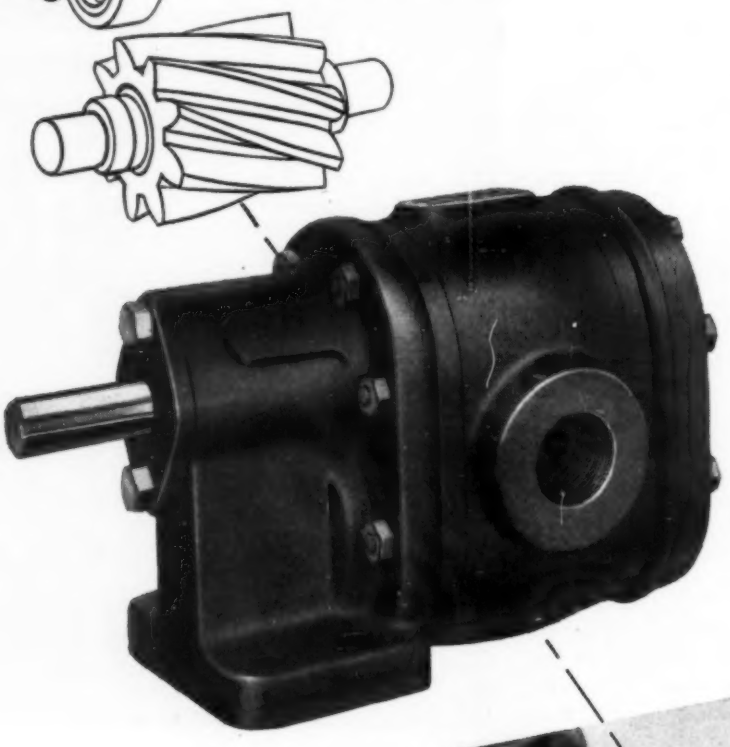
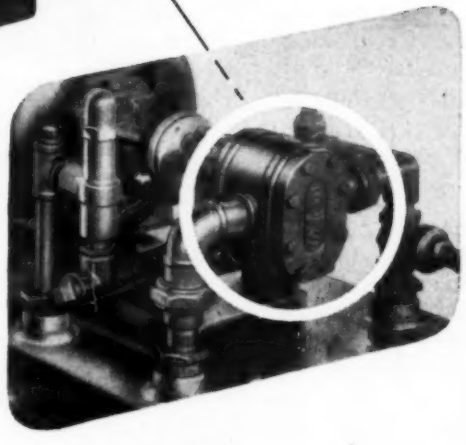
Smooth-operating quiet hydraulic systems start here





Rotary Geared Pumps with Helical Gears and Roller Bearings

Here's an easy way to add extra features to the design of hydraulically-operated machines . . . a quiet-operating pump that provides smooth continuous flow. By specifying Brown & Sharpe Rotary Geared Pumps with helical gears made to extreme accuracy and operating on roller bearings, you can assure these features. What's more, trouble-free service life of the pump is extended too!

Brown & Sharpe Rotary Geared Pumps with helical gears and roller bearings are made in two sizes: No. 53 — 4 to 23.3 gallons per minute at 0 lbs. pressure; and No. 55 — 9 to 34.1 gallons per minute at 0 lbs. pressure. Although designed for direct drive, these pumps may be driven by pulley or gear. Made to run in one direction only, either clockwise or counterclockwise. Leakage and gland adjustments present no problems because the pumps have a mechanical seal.

Let these pumps help you *advance* your machine design by supplying oil under pressure for hydraulically-operated machines, or for lubrication systems where quietness is essential. Get all the facts. Write for Pump Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

GEARED • VANE • CENTRIFUGAL • MOTOR DRIVEN

We urge buying through the Distributor

Brown & Sharpe

B·S

LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

Continued from page 25

FLUID FLOW VALVE with which the exact rate of flow of air, oil or water can be predetermined, is described in illustrated valve Bulletin No. 257, available from Hanna Engineering Works.

Circle 46 on Reader Service Card

TUBE FITTINGS featuring an alloy spring steel sleeve are outlined in Catalog No. 502 prepared by Flodar Corp.

Circle 33 on Reader Service Card

FLEXIBLE COUPLINGS and their advantages are detailed in illustrated catalog, issued by Lovejoy Flexible Coupling Co.

Circle 71 on Reader Service Card

BALL VALVE which is applicable for liquids, gas or steam and is leakproof, is detailed in a folder available from the Foxboro Company.

Circle 34 on Reader Service Card

NON-FLAMMABLE FLUID, for hydraulic applications where high heat or fire hazards are problems, is described in a booklet "Pydraul F-9" published by the Monsanto Chemical Company.

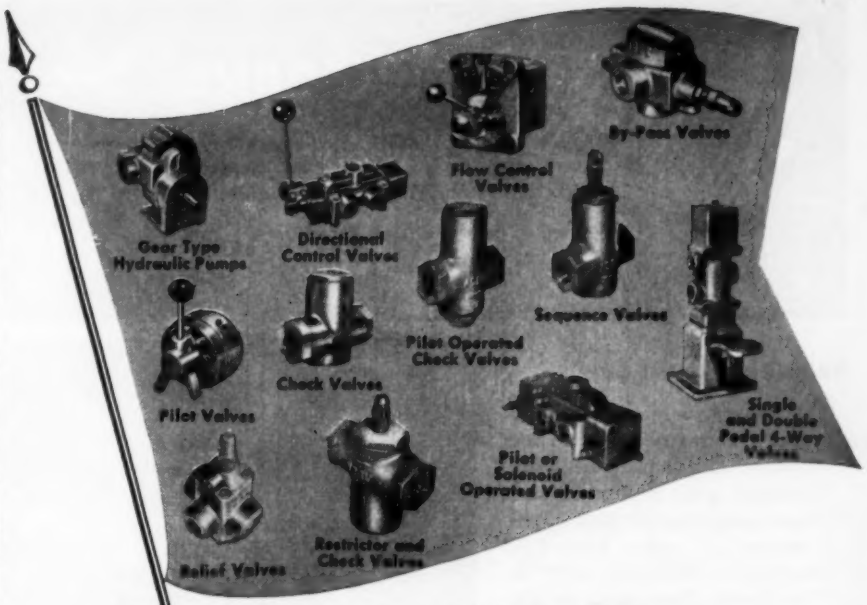
Circle 79 on Reader Service Card

INDUSTRIAL TIMERS, which help to speed production are described in general bulletin 340 offered by Eagle Signal Corporation.

Circle 29 on Reader Service Card

ELECTRIC MOTORS for hydraulically operated equipment are described in literature available from the Electro Dynamic Division of General Dynamics Corporation.

Circle 30 on Reader Service Card



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ADEL *Refinements* assure Plus Performance for Your Equipment

Designers and Engineers have set these standards for Industrial Hydraulic Equipment

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ADEL brings them all to you!

Smooth economical hydraulic power for Pushing, Pulling, Lifting, Pressing, Clamping and Controlling.

Illustrated are but a few of a wide variety of ADEL industrial hydraulic control equipment that offer definite benefits to both the user and builder of machine tools and many other kinds of equipment. ADEL products incorporate proven design and precision construction features that assure dependable operating efficiency over the years. A complete line for every application. You can simplify your Hydraulic Power Motion Problems by specifying ADEL.

A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF INDUSTRIAL HYDRAULIC CONTROL EQUIPMENT. INQUIRIES INVITED.

For complete engineering specifications and counsel, Address: ADEL DIVISION, GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California

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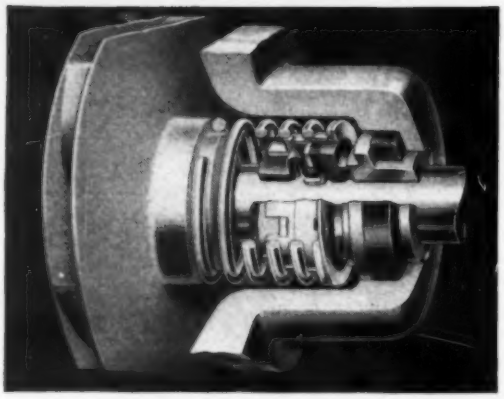
Circle 3 on Reader Service Card

There's a JOHN CRANE Mechanical Seal To Meet Your Exacting Requirements

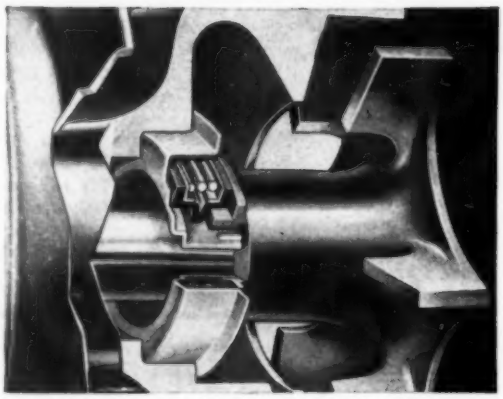
General Purpose Seal...

...most widely used end-face seal in industry... ideal for centrifugal, rotary and jet pumps, gear reducers and many other rotary shaft applications... offers long life, complete flexibility, easy installation. Two types available, No. 1 and 2, for varying equipment space conditions.



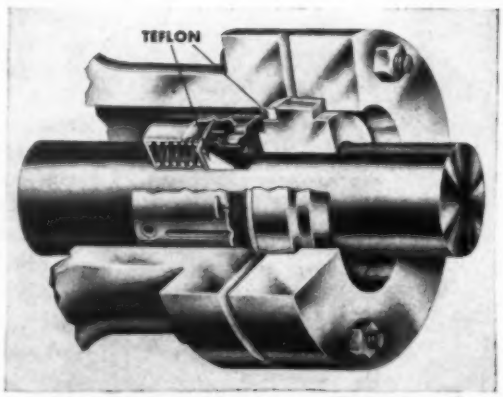
Low Cost, High Quality "Pressed-in" Seal...

...the answer to small shaft sealing applications involving high speeds and vibration. Millions of these Type 6A Seals are mass-produced for automotive water pumps, making them available at a relatively low cost in stock sizes. Each of these easy-to-install seals will fit all shaft sizes from 1 1/16 in. down to as small as 1/4 in. and under.



High Temperature Anti-Corrosive Seal...

...This Type 9 Seal performs effectively at temperatures up to 485° F. It incorporates a *Teflon* flexible member which is unaffected by all known corrosive agents.



★ ★ ★

All seals in the "John Crane" line are end-face in design ...nothing touches the shaft which can score it. No matter what your mechanical sealing problem is, there's a "John Crane" seal designed to exactly "fill the bill". Our trained field engineers are ready to work with you in selecting the best seal for your needs.

Write for entirely new catalog on "John Crane" Mechanical Seals. It's just off the press!

PACKINGS — MECHANICAL SEALS — TEFLON PRODUCTS — PIPE SEALING COMPOUNDS — LAPMASTER LAPPING MACHINE

JOHN CRANE

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Problems of Metal Industry To Highlight Plant Maintenance Conference

In recogniton of sky-rocketing costs of maintenance in the steel and metal industry and the added engineering and personnel problems due to increasing mechanization, it has been decided to set aside two sessions of the forthcoming Plant Maintenance Conference exclusively to a discussion of maintenance in steel mills and fabricating plants, and two more to maintenance in foundries.

The conference takes place at the Public Auditorium, Cleveland, January 19-22, concurrently with the Plant Maintenance Show, where thousands of machines and products needed in maintenance will be exhibited.

In addition to the special sessions mentioned, there will be 62 other meetings dealing with general aspects of plant maintenance. These include such subjects as preventive maintenance, sanitation, lubrication, incentive systems, power plants, pumps and piping, maintenance stores, training workers, maintenance budgets, lighting, work standards, building maintenance, electrical and mechanical equipment maintenance, corrosion control and similar problems. Problems depending on the size of plant and the maintenance force will be treated separately so that executive personnel from small, medium-sized and large plants may discuss those subjects most directly involved in their own operations.

Acushnet Holds Bi-Annual Sales Conference

The Molded Rubber Division of Acushnet Process Company, New Bedford, Mass., held a four day bi-annual sales conference, September 3-6. In addition to technical sessions, which brought sales personnel and representatives up-to-date on classifications and techniques of manufacture of "O" rings, mold design, stock compounding and production techniques, sessions were devoted to the Company's sales policies, research and development facilities and programs. A premier showing of Acushnet's new 20 minute 16mm color-sound film, "Molded Rubber—Indispensable in Industry" was included. This film will be released for general showing.

We don't want to return your order!

The Rivett organization is doing a tremendous job of trying to keep up with the demand that has developed during the past several years for Rivett components. We are receiving more valve and cylinder orders today by far than we thought possible 18 months ago.

Capacity has been increased, new machinery installed, production techniques improved, and a large inventory of finished parts built up, ready for assembly.

The one thing responsible for this demand, and the occasion for this message, is the reputation for quality which Rivett products have earned. We must maintain our standards of workmanship in the face of this increased business. And when you send us an order for equipment which is not catalogued as a standard item, we cannot always make delivery as quickly as we both would like. It brings tears to our eyes when we find you will not wait a very short while for the extra quality of a Rivett specially designed component.

To help expedite your Rivett order, we offer these suggestions:

1. Contact your Rivett representative. He can recommend the correct valves and cylinders and make circuit suggestions which may save you time and money. Also, he may have in his stock the exact component you need. And he can improvise your circuit until new Rivett components arrive.
2. Stick to standard components in designing your circuit. Rivett catalogs over 400 standard models, and can deliver faster from semi-assembled stock.
3. Anticipate your requirements early and place your order promptly.
4. If you do need a special design and cannot wait a short while for the extra quality of Rivett, then ask your Rivett representative to recommend the next best source who can handle your requirements. His suggestion may help to save you time and money later.

Newark & New York—Compressed Air Products, 1977 Springfield Ave., Maplewood, N. J., 257 Greenwich St., New York City 7, N. Y.
Philadelphia, Pa.—The Battersby Co., 3701 N. Broad St.
Boston, Mass.—L. W. Sheehy, 1104 Park Sq. Bldg.
Baltimore, Md.—Colliflower, Inc., Baltimore National Pike, Ellicott City, Md.
Rochester, Syracuse and Buffalo, N. Y.—Windheim Tool Company, 24 Ford St., Rochester 8, N. Y.
Pittsburgh, Pa.—F. R. Magill Co., 44 McKnight St.
Cleveland, Ohio—Garco Machy. Co., 21000 St. Clair
Detroit, Mich.—Fors Sales Co., 2832 E. Grand Blvd.
Flint, Mich.—Shively Sales Company, 719 E. 2nd Ave.
Chicago and Milwaukee—MacMillin Engineering Corp., 1737 Howard St., Chicago 26, Ill.
St. Louis, Mo.—William Scheer Co., 6376 Clayton Rd.
Dayton, Ohio—Seifreat-Elstad Machy., P.O. Box 332
Cincinnati, Ohio—Seifreat-Elstad Machy., P.O. Box 2508
Columbus, Ohio—Seifreat-Elstad Machy., P.O. Box 922
Columbus, Ga.—Bunn H. Martin, P.O. Box 350
Minneapolis, Minn.—Anderson Machine Tool Co., 2641 University Ave., St. Paul 4, Minnesota
Denver, Col.—Iver J. Esbenson Co., 1249 Calif. St.
Los Angeles, Calif.—The Paul-Munroe Co., 4867 E. Gage Ave., Bell, Calif.
San Francisco, Calif.—Ditzen Engineering and Sales, 600 16th St., Oakland 12, Calif.
Oregon and Washington—Hydraulic Power Equipment Co., 2316 N. W. Savier St., Portland, Ore.
Canada—Duncan Machinery Co., Ltd., 1922 Wyandotte St. East, Windsor, Ontario; 371 Bay St., Toronto

RIVETT LATHE & GRINDER INC. • Brighton 35, Boston, Mass.
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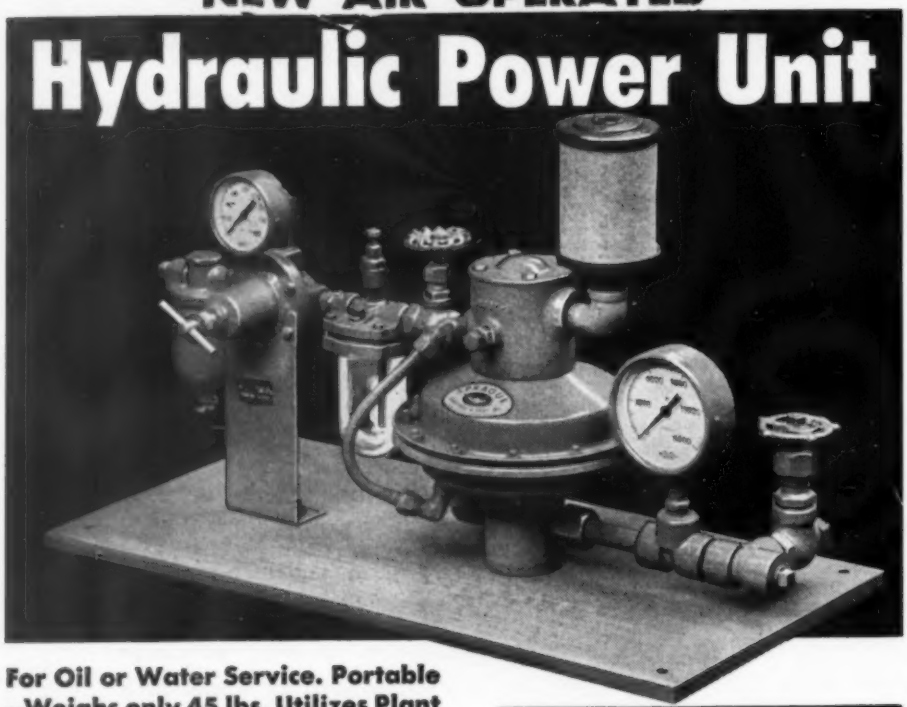
RIVETT furnishes a complete power package

VALVES • CYLINDERS • POWER UNITS
Air and Hydraulic
All sizes and types

NEW AIR OPERATED
Hydraulic Power Unit

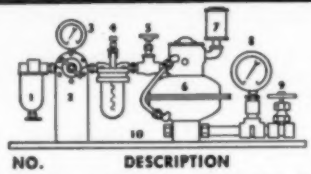


For Oil or Water Service. Portable —Weighs only 45 lbs. Utilizes Plant Air Supply to Provide Output Fluid Pressures to 30,000 PSI.

Sprague Model S-440 Power Unit is simple to install. Requires only two connections – one to plant air supply line and the other to manifold, etc. from outlet fluid port of power unit for *immediate operation.*

The Sprague pump operates *automatically* on the principle of differential areas. It can be furnished in six models with ratios of from 35:1 to 300:1 making possible an output range from 3,500 to 30,000 PSI. Measures 12"x12"x24" complete.

Models S-440 is broadly applicable for a wide variety of uses where low volume output at high pressure is the requirement, such as hydrostatic testing. Uses either oil or water as the testing medium. Write today for complete information.



NO.	DESCRIPTION
10	Masonite Base ½"x12"x24"
9	Bleed off Valve
8	Pressure Gauge
7	Air Muffler
6	Sprague S-216C Pump
5	Air Shut off Valve
4	Air Lubricator
3	Air Gauge
2	Air Regulator
1	Air Filter

AVAILABLE SEPARATELY

Sprague Model S-216C Air Operated Hydraulic Boost Pump is available as a separate unit for custom installations. Measures 8¼" wide x 9⅝" deep. Simple, reliable, inexpensive. Thousands in use.

Assembly No.	Ratio	Recommended Air Pressure	Maximum Fluid Pressure	Prices, F.O.B. Gardena, Calif.
S-440- 35	35:1	100 PSI.	3,500 PSI.	$278.25
S-440- 60	60:1	100-150 PSI.	6,000 PSI.	$278.25
S-440-100	100:1	100-150 PSI.	10,000 PSI.	$278.25
S-440-150	150:1	100-150 PSI.	15,000 PSI.	$299.50
S-440-200	200:1	100-150 PSI.	20,000 PSI.	$350.00
S-440-300	300:1	100-150 PSI.	30,000 PSI.	$414.00

Six standard models for output fluid pressures to 30,000 PSI. from 100-150 PSI. plant supplied air pressure. Other models with lower and higher (to 50,000 PSI.) capacities supplied on special order.

REPRESENTATIVES—New York, Tiverton, R. I., Philadelphia, Cleveland, Dayton, St. Louis, Chicago, Logansport, Wichita, Dallas, Houston, Denver, Seattle. CANADA —Exclusive Distributor: Rousseau Controls, Ltd., Montreal Airport, P. Q.

SPRAGUE *Engineering and Sales Corp.* ★ 1144 WEST 135TH STREET GARDENA, CALIFORNIA

LETTERS *to the Editor*

Could you tell us where we could obtain information on a welded hydraulic piping system for 2 inch pipe size. We find that flare type fittings are common only up to 1¼ inch size. We would be interested in the method of welding used, the type of end connections and the know-how required. We have in mind 1000 psi operating pressure systems with 3000 psi surge or shock pressure.

RICHARD OLSEN
Kux Machine Company

This could be answered more fully if the shop volume were known. We can say that the type of welding indicated is electric arc and that the work may be done either manually or automatically, depending upon the amount of work and on the type of material. Mild steel is welded comparatively easy, some of the alloys present more of a problem. There are two large firms in your area that do contract welding that could give you details of the know-how required. These are Chicago Bridge Co. (Mr. Perry Arnold or A. P. Bunk) and Taylor Forge & Pipe Works. We will be glad to hear from any reader who has had experience with welded hydraulic connections.

We are interested in the possibility of using one of the newer high strength plastic materials as bodies or casings for hydraulic and pneumatic reciprocating rotary actuators which we manufacture.

B. J. BONNOT,
Bonnot Mfg. Co.

Checking, which we have done, indicates that there are three possibilities of plastic formulations that might be used. These are reinforced phenolic laminates, rigid polyvinyl chlorides and fiber glass reinforced special formulations. One of the leading plastic material manufacturers has just put on the market a high impact vinyl which is worth considering for the purpose. Design, tolerances that must be held, corrosion effects, machineability and probably other factors must also be considered.

Continued on page 50

"Tycol Armitage boosts bearing life... smooths the way for faster, heavier loads"

Of course! Tycol Armitage Bearing Grease "stays put" ... keeps anti-friction bearings running smooth and cool. Its high stability makes it suitable for sealed anti-friction bearings that must last the life of the equipment.

Tycol Armitage possesses exceptional resistance to oxidation.

The dependable lubricating ability of this quality grease lengthens bearing life and cuts down maintenance costs.

Call your nearest Tide Water Associated office for further information.

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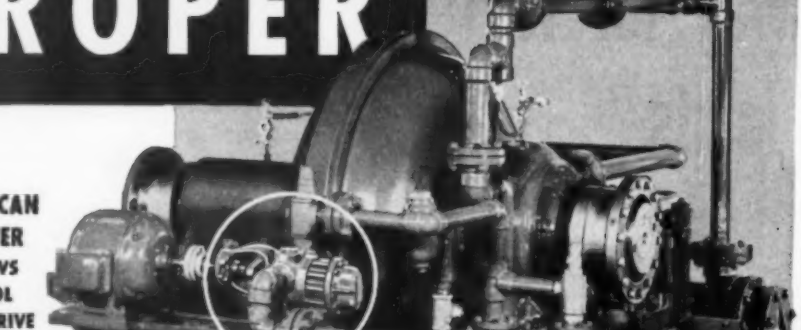
ROPER



AMERICAN BLOWER TYPE VS GYROL FLUID DRIVE

ANOTHER EXAMPLE SHOWING ROPER PUMPS AS INTEGRAL PARTS OF MODERN MECHANISMS

Gyrol Fluid Drives — for supply pumps, compressors, draft fans, and other industrial applications — use Roper Pumps to govern speed variation. In this model, the oil is taken from the oil reservoir and is added to the Fluid Drive working circuit to increase speed, or oil is removed from the circuit to decrease speed. The lubricating oil is constantly fed to all bearings. The Fluid Drive unit shown is a size 27 Type VS with maximum ratings of 518 HP at 1400 RPM.

SERIES F PUMP

Roper Series F Pumps — the models used as original equipment on Gyrol Fluid Drives — are recommended for pressures up to 300 PSI and come in 1 — 300 GPM sizes. They feature 4-port design offering eight optional piping arrangements (4 for CW and 4 for CCW rotations) . . . a factor which cuts installation time and costs. Equal size gears run in axial hydraulic balance; pumps furnished in standard or stainless steel fitted models; available with or without relief valve — with mechanical seal or packed box. Investigate what Roper Rotary Pumps can do for you!

SEE OUR CATALOG IN SWEET'S

GEO. D. ROPER CORP.
711 BLACKHAWK PARK AVE.
ROCKFORD • ILLINOIS

ROPER
Rotary Pumps

Letters to the Editor

Continued from page 40

I work in a research laboratory on hydraulics and find APPLIED HYDRAULICS very helpful. I would like to know if the series on "Beginners Course on Basic Hydraulics" has been made up in booklet form.

J. R. MAHER, JR.
Bldg. 5, Hughes Aircraft Co.

We are glad to know that you are finding APPLIED HYDRAULICS helpful to you. The series "Beginners Course in Basic Hydraulics" was not reprinted in booklet form. A Navy training text "Basic Hydraulics" is available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.: a cloth cover edition sells for $1.50, *a paper cover at* $1.00 *per copy.*

We are presently engaged in an experimental project wherein we must calculate velocity and volume of air under pressure through pipes and through rectangular passages and valves. Any data concerning the above such as tables, formulas or nomographs would certainly be appreciated.

WILLIAM F. HOLICKY,
Design Engineer,
Garfield Heights, Ohio

Velocity and volume of air under pressure through pipes can be determined by the Sturdevant formulas (developed by the B. F. Sturdevant Co.). These formulas are:

$v = 25{,}000\,dp$ and $p = \frac{Lv^2}{25{,}000\,d}$, in which

v = velocity of air in feet per seconds

p = pressure loss in ounces per square inch

d = ID in inches

L = Length of pipe in feet

A table which gives loss in psi per 10 feet of length of pipe for air line velocities from 10 to 750 feet per second, based on the Sturdevant formulas, has been prepared as a data sheet by the Miller Motor Company. Loss of air pressure due to friction for 100 psig and for 80 psig initial pressures are shown in Figures 2 and 3 in the October installment of the "Beginners' Course in Basis Pneumatics" (pages 44 and 45). Losses for other initial pressures are shown in similar tables in the "Compressed Air Handbook", "Compressed Air Data" and "Piping Handbook".

We do not know of tables or formulas for velocity of volume of air

Continued on page 54

FREE Cylinder Catalog and Templates offered by Ortman-Miller Co.

Book outlines several special features of O-M cylinders.

FREE

A new, 28 page catalog has just been released by the Ortman-Miller Machine Co. which gives complete engineering specifications, data on O-M's special internal locking system and special full listing of O-M parts. Prepared for designers and users of cylinders for any application, it covers standard, oversize and 2-1 piston rods, giving full information on all sizes from 1½" to 8" bores.

SPECIAL FEATURES

Included are detailed explanations of the many features which have made ORTMAN-MILLER cylinders standard in thousands of plants throughout the country. Detailed drawings and copy explain the special shear bar assembly which completely eliminates bulky end caps and tie rods, thus saving up to ⅓ in space. In addition, it shows the vast number of interchangeable mountings and applications which almost always eliminate the need for special castings or patterns. This feature alone not only saves initial costs, but cuts down on inventory and greatly speeds up delivery on every order.

Special Note:

14 DAY DELIVERY

Increased production facilities and standardization of parts continue to make possible delivery in 14 days or less on almost all orders for O-M cylinders. Write today for details.

FREE TEMPLATES

In addition to the FREE catalog, Ortman-Miller also leads the field in making available FREE TEMPLATES of all O-M cylinders. Prepared in half and quarter scale, they are extremely useful in design and application of O-M cylinders to your special requirements.

For your FREE Catalog or templates, use the coupon in the ad at the right. Or write to ORTMAN-MILLER Machine Co., 1204 150th St., Hammond, Indiana.

4 REASONS WHY

YOU SHOULD USE O-M AIR, WATER & HYDRAULIC CYLINDERS

1 14 DAY DELIVERY

Complete standardization of interchangeable parts and elimination of need for special patterns and castings mean faster production, lower costs. Even the most difficult "custom" applications can almost always be made from O-M standard cylinders . . . without delay!

2 NO TIE-RODS, BOLTS or SCREWS!

New simplified design completely eliminates bulky end caps and tie rods, saves up to ⅓ in space. No bolts or screws. Special circumferential keys allow quick, easy installation, even faster repacking.

3 MACHINED STEEL, NO CASTINGS

All cylinder body parts are bar stock steel, made in automatic screw machines. No castings whatsoever. All bearing surfaces are bronze.

4 SAVE SPACE, TIME AND MONEY

O-M special features mean less inventory . . . increased uses from standard sizes. Interchangeable mounting brackets, ports adjustable to any angle. Full range of sizes from 1½" to 8" bores.

FULL DETAILS IN COLUMN AT LEFT

FREE!

NEW CATALOG
Gives full details, data and specifications on all O-M cylinders. Standard, oversize & 2-1 piston rods.

TEMPLATES
Complete set of ½ or ¼ scale templates showing all cylinders and mounting brackets.

ORTMAN MILLER MACHINE CO.
1204 150TH St.
HAMMOND, INDIANA

Ortman Miller Machine Co.
1204 150th St., Hammond, Indiana

Please send me——FREE CATALOG of O-M cylinders
——FREE SET of ½ scale templates
——FREE SET of ¼ scale templates

Name_____ Position_____

Company_____

Address_____

City_____ Zone____ State_____

Keep your hydraulic oils, and coolants clean with . . .

SPARKLER FILTERS

designed specifically for this purpose. A practical protection for hydraulic machinery and cutting tools

The VR filter is designed for filtering hydraulic oil, quenching oils, transformer oil, solvents and other industrial liquids.

The Sumptype filter is ideal for filtering coolants. The filter plate assembly is attached to the intake pipe of the circulating pump and the coolant is drawn through the filter discs and delivered clean and free from all metal particles and grit, to the nozzels.

★ Clean hydraulic oil greatly prolongs the life of all moving parts, such as pistons, cylinders, pumps, valves, etc.

★ Filtering hydraulic oil extends the life of the oil. Drain and leakage oil may be reclaimed. One large user of hydraulic machinery saved $90,000.00 in hydraulic oil alone in one year by filtering oil with Sparkler Filters.

★ Filtering hydraulic oil eliminates sticking and clogging of valves and reduces down time and maintenance cost. A prominent authority on hydraulic machinery says that 70% of servicing and repairs is due to the improper condition of hydraulic oil.

★ Filtering coolant fluid removes all fine metal particles and grit from grinding wheels that is pumped back to nozzles unless a filter is employed in cleaning up the return coolant.

★ Clean filtered coolant prevents scratching and flat spots on work piece and increases the life of grinding wheels and cutting tools. Reduces the frequency of dressing grinding wheels.

The Sparkler VR filter is constructed on a simple filtering principle using filter paper as a media. The filter plates can be removed easily for cleaning which consists only of removing the dirty paper and replacing with fresh sheets. Any shopman can make this change of paper in a few minutes. The cost of replaced paper is less than a dollar per change.

Let a Sparkler representative demonstrate these filters in your plant

SPARKLER MANUFACTURING CO.
Mundelein, Ill.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

Letters to the Editor

Continued from page 50

under pressure through rectangular passages. While some heating and ventilating systems call for high velocity of air flow through rectangular pipe or trunk lines, pressures involved are very nominal.

Unfortunately, manufacturers of pneumatic units have not published tables which show loss due to friction. This is true of bends and turns, fittings as well as valves. Due to the wide range of design of air valves, both velocity and volume would vary with changes in direction of air flow and arrangements of porting as well as changes of friction due to the path of air flow. For purposes of estimating total pressures losses in air systems, the table published both in the "Compressed Air Handbook" and the "Piping Handbook" (pages 338 and 100 respectively) is commonly used. This table gives losses in terms of equivalent lengths of straight pipe.

Nomographs for velocity and volume of air under pressure are not in general use. Only a few such charts are to be found in manufacturers' literature. The group of nomographs in the Appendix of Gill's "Air and Gas Compression" may be useful. The most complete work on the subject, Kulmann's "Nomographic Charts" confines itself to water hydraulic charts.

Can you give us the name of manufacturers of small size rotary type compressors.

J. CADGENE,
President,
Cadgene Machinery Co.

We are sending you such a list from the Classified Products section of our 1952 Directory.

Do you have an annual or semi-annual Index showing listings of subjects published in your magazine? Such a list would be of considerable importance to our organization.

R. S. BERGNER,
Administrative Engineer,
Ordnance Division,
American Locomotive Co.

Both a title and author index of articles which appeared during 1951 in APPLIED HYDRAULICS was published in the Directory issue (January 1952). Similar lists for 1952 will appear in the next Directory issue (January 1953).

Circle 105 on Reader Service Card

Circle 77 on Reader Service Card

Miller

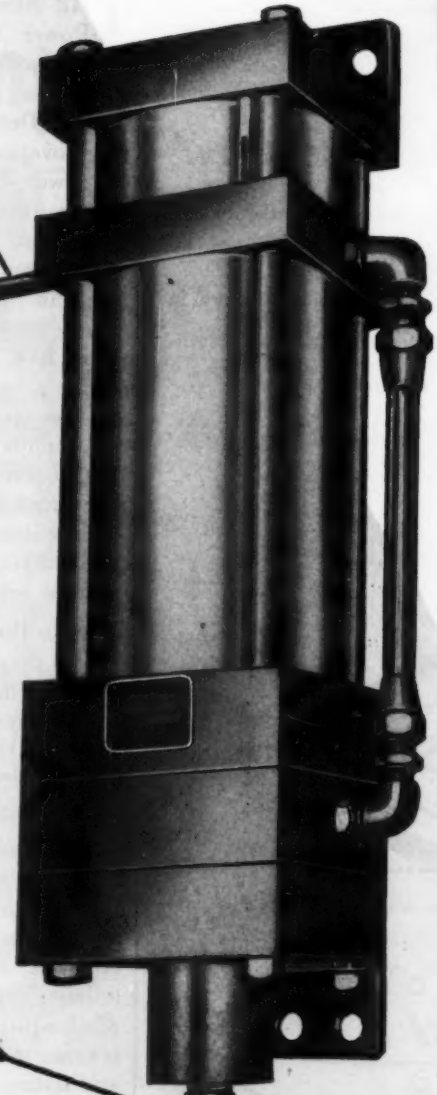
FLUID PRESSURE BOOSTERS

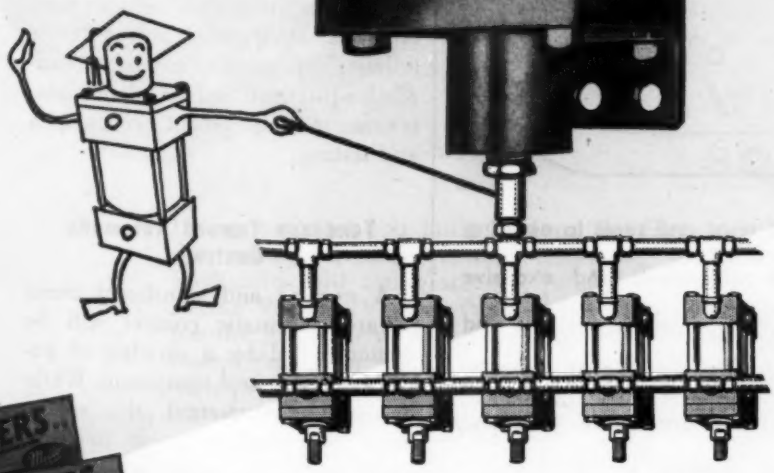
BOOST 80 PSI AIR

Input Range: 40 to 3000 psi Air or Fluid

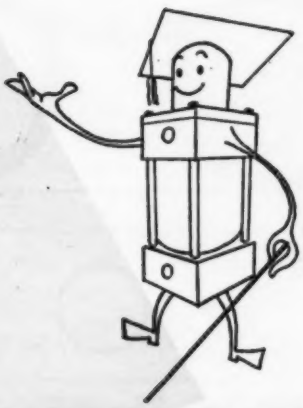
TO 2000 PSI HYDRAULIC PRESSURE

Output Range: 200 to 10,000 psi Fluid





- Save space, weight and investment cost by replacing pump installations in many applications
- Less costly to install, operate and maintain
- **Hold pressure indefinitely** without the motion and heat generation of ordinary pump circuits
- Provide—at point of cylinder thrust—more efficient power with less weight in less space than direct driven air cylinders
- Save up to 95% of air consumed by direct driven air cylinders
- Operate at speeds of 30 to 450 strokes per minute



ESPECIALLY RECOMMENDED FOR

- **WELDING**
- **PUNCHING**
- **SHEARING**
- **CLAMPING**
- **RIVETING**
- **CRIMPING**
- **PRESSING**

and similar applications

FULL DETAILS IN MILLER BULLETIN B-200 SENT FREE ON REQUEST

Other Miller products include: Air cylinders, 1½" to 20" Bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

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RINGS & SEALS
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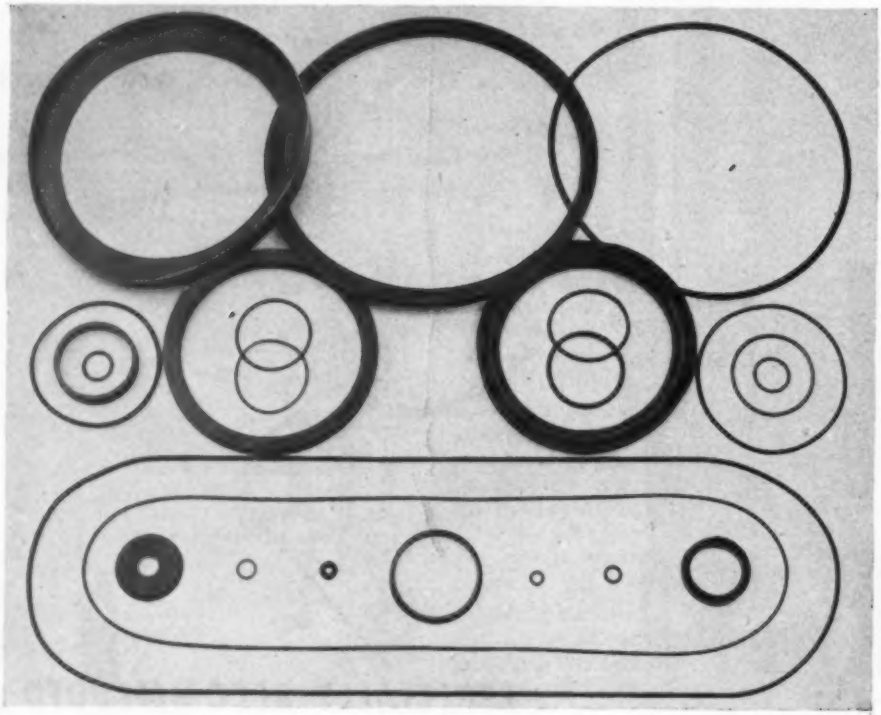
Synthetic rubber and Silicone "O" rings, lip-type seals and cups are constantly finding new applications formerly handled by leather, asbestos, flax and many other similar materials. They have been used in many applications to replace stuffing boxes, multiple packing sets, complicated adjusting devices and other expensive machined parts.



Acushnet produces great quantities of rings and seals to exacting specifications, and has developed many compounds and exclusive methods of fabrication for this type of part. Our long experience and quality controlled production assure the highest standard of precision.

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PROCESS COMPANY
New Bedford, Mass., U. S. A.

These items are made to order, none are stocked.

Rubber Handbook sent on request.

Address all communications to 794 Belleville Ave., New Bedford, Mass.

20th National Power Show
Meets Dec. 1-6

THE 20th National Exposition of Power and Mechanical Engineering will be held in Grand Central Palace, New York City, the week of December 1-6. The Exposition covers all branches of the field of power from the conversion of energy into fluid forms, such as heat, light, flowing water, hot, cold and compressed air, to its applications in moving mechanisms. It includes the conversion processes themselves, such as the combustion of fuels, generation of electricity and the operation of heat exchangers, pumps and blowers; distribution in transmission lines and pipelines, and includes all of the many applications within the industrial plant, through wires, piping, shafting and belts.

As in the past attendance is limited to persons having a professional, scientific or personal interest in the exhibits. Visitors are admitted by invitation and registration, without registration fee. The general public is excluded.

Exhibitors numbering more than 300 have reserved all the available space in the three floors of the Palace. Major exhibitors include: power plant equipment, power transmission equipment, materials handling equipment, safety, plant maintenance and equipment for research and testing.

Tendency Toward Automatic Controls

A marked and significant trend toward automatic control will be demonstrated by a number of exhibitors of control equipment. While basically instrumental, this movement represents a joint development with the manufacturers of processing and manufacturing equipment and machines. In the newer plants a single control room can operate all power services. Automatic control is highly economic in its application to processing equipment and to machine tools to regulate performance to pre-determined levels and, in many cases, to replace intricate calculations as well.

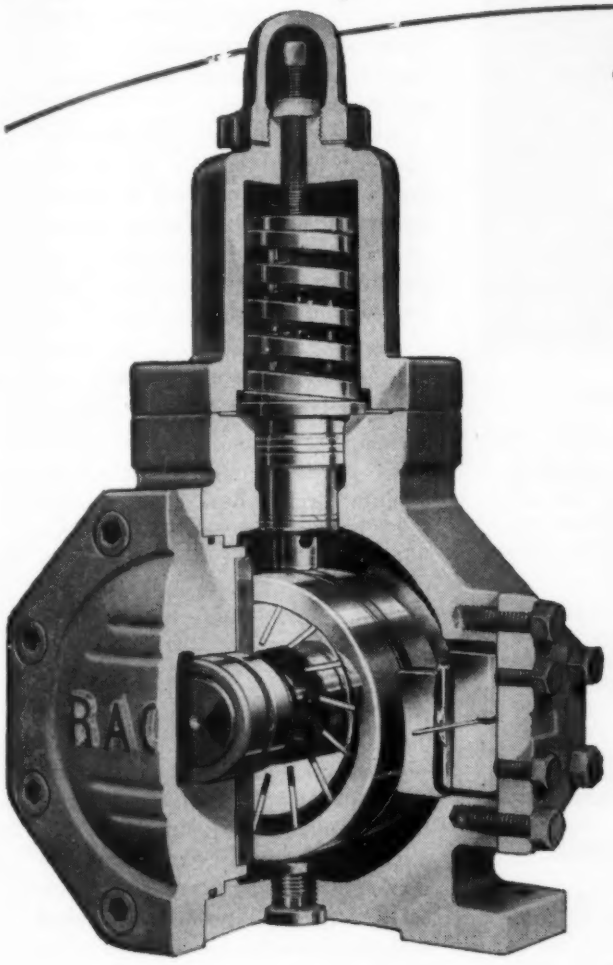
For example, the manufacturer of

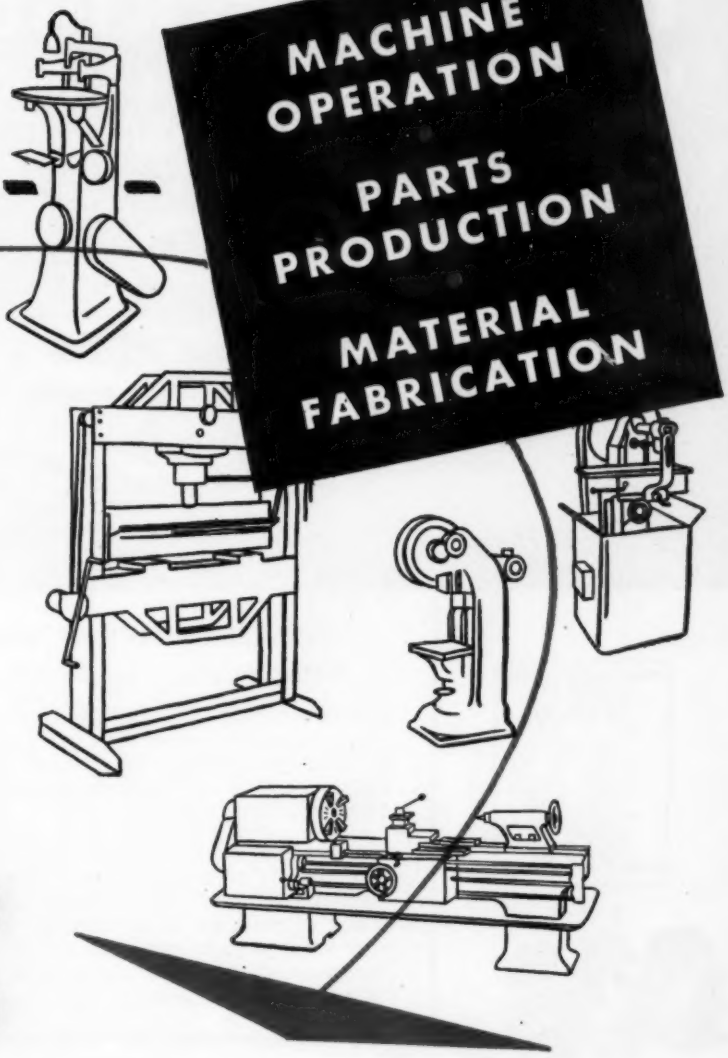
RACINE Will Improve - - - -

MACHINE OPERATION

PARTS PRODUCTION

MATERIAL FABRICATION





WITH *Hydraulic* POWER MOVEMENT

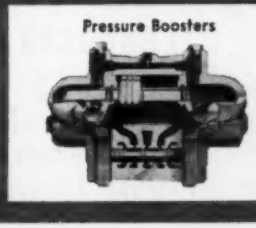
If the machines you build perform bending, forming, feeding, molding, pressing, forcing, die casting, drilling, lifting, embossing or baling operations, the inclusion of Racine Hydraulics will assure smooth, positive economical operation.

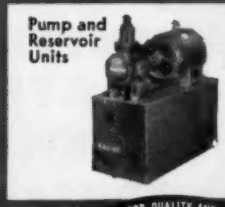
Racine Variable Volume Pumps with interchangeable governors deliver only the oil needed for the job. No wasted power, no overheating, neither by-pass nor relief valves — Racine Pumps put *all of the oil to work.* These features assure a simple, efficient hydraulic circuit with proven installation and operating economies. Capacities up to 70 gpm at 1000 psi. Valves in a wide range of types and sizes.

Write for complete hydraulic equipment catalog.

BUY DEFENSE BONDS

OTHER RACINE HYDRAULIC PRODUCTS





RACINE HYDRAULICS & MACHINERY, INC.

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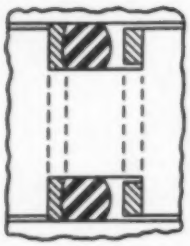
STANDARD FOR QUALITY AND PRECISION — RACINE HYDRAULICS & MACHINERY, INC. — RACINE

TEFLON PACKINGS

for Hydraulic & Pneumatic Cylinders, Presses, Pumps, Valves



CHEMISEAL BACK-UP RINGS

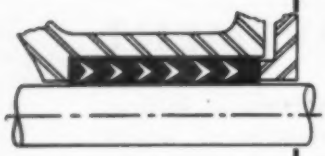
Protect Packing — Lengthen Its Life

For protecting O-rings and other packing from extrusion, deterioration and loss of efficiency—select Chemiseal Back-up Rings, made of Teflon—a natural for hydraulic service.

These rings are chemically inert, can't be affected by oils or solvents. They won't harden, soften, swell or shrink in service. Tough, resilient, they support the packing with which they are used, greatly lengthen its life. Try them, and you will standardize on them.

CHEMISEAL V-TYPE PACKING

The ideal valve packing that seals with low gland pressures and operating torque, made from solid Teflon or Teflon compounds. Extremely resilient, tough and anti-hesive—it cannot seize the valve stem or shaft—is long wearing, impervious to all hydraulic fluids, outlasts other packings several times over. Supplied in sets with square-end Teflon adaptors. Send for catalog No. 810 V.



*du Pont's trademark for its tetrafluoroethylene resin

UNITED STATES GASKET COMPANY

FLUOROCARBON PRODUCTS DIVISION

FABRICATORS OF "TEFLON", "KEL-F" AND OTHER FLUOROCARBON PLASTICS

CAMDEN 1, NEW JERSEY

a line of electronic transmitters, which instantly transmits to the control board information on pressure, temperature, rate of flow and liquid level and relays controller signals to remote switches and valves, has added an electronic pressure relief valve for boiler service that assures accurately balanced operation at peak loads, more uniform pressure on the line, conserves power, decreases maintenance of spring-loaded safety valves and guards against overheating.

Another exhibitor, a manufacturer of liquid meters, points out that the uses of metering is new to many industries and that the use of meters for record purposes is expanding to the more important function of control of liquid flow.

Exhibits Include Power Components and Machine Tools

Standard units exhibited serve many purposes. For example, one manufacturer of heat exchangers reports his units in use to cool water for continuous annealing lines, electrolytic tinning, cleaning, pickling lines and for precipitron cleaning in a steel mill.

A well-known manufacturer of equipment for handling fluids will display a recently designed self-supporting rotary pressure joint which is completely packless, self-lubricating, self-adjusting and self-aligning. It is used for rotary drying and cooling rolls in the paper, textile, rubber, plastics, chemical and food industries. Another exhibitor will show a new line of revolving joints that require no lubrication or packing and are self-aligning when mounted with flexible hose. In the same field, still another manufacturer will offer a new idea in swivel fittings, adapted to most loading arm installations.

In the machine tool section of the show a substantial group of exhibits featuring tool room, plant maintenance and manufacturing machines will be shown. One innovation is a three-spindle drill press turret head, another a rotary table attachment which converts a drill press into a vertical miller.

Still another exhibitor will introduce a power tool with integrally motored unit that will saw, sand, grind, scratch-brush, buff, polish, drill, shape and plane. This unit

can also be used to drive a flexible shaft and, through a power take-off, other light shop equipment, such as a lathe or air compressor.

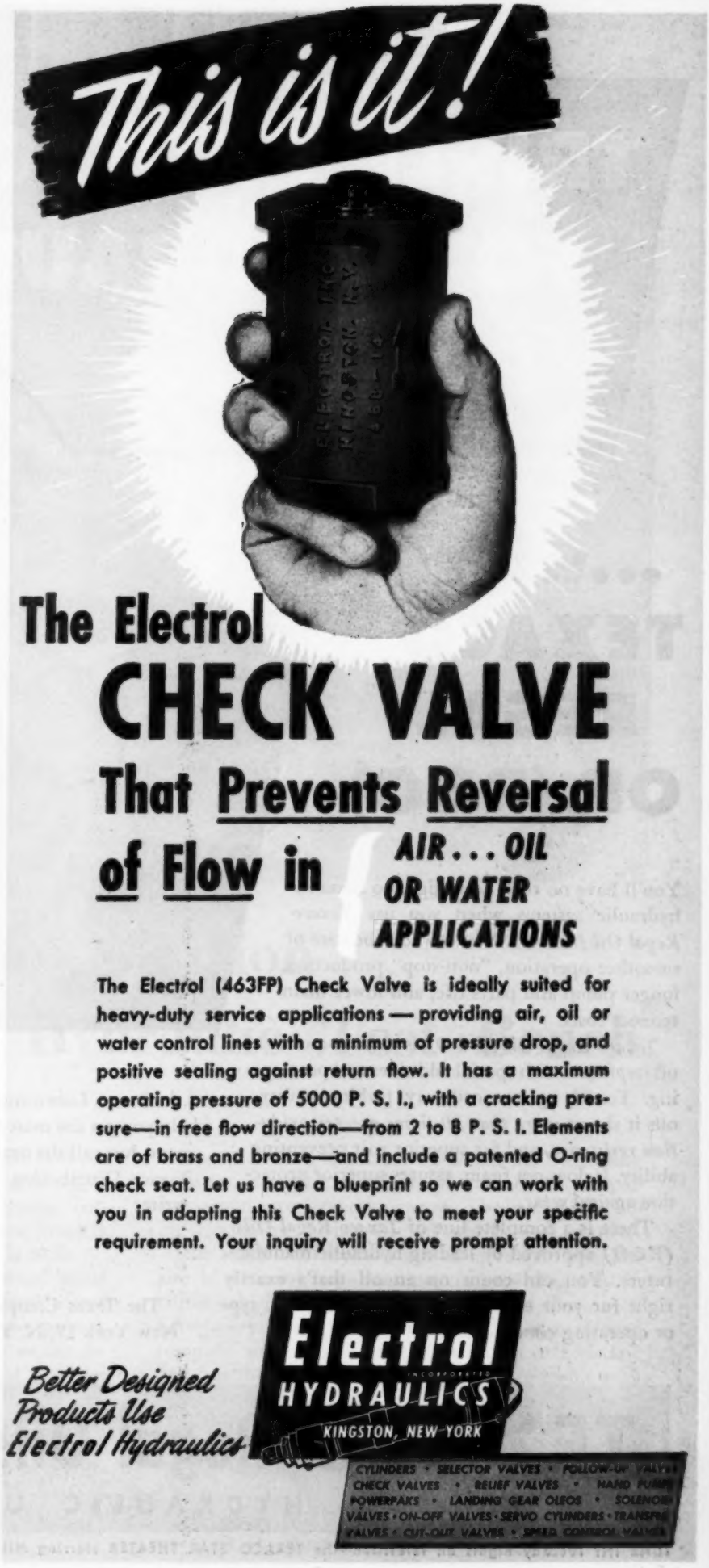
The Exposition will be held simultaneously with the annual meeting of the American Society of Mechanical Engineers, which will headquarter at the Statler Hotel where business and technical sessions will be held.

Cylinder Exhibit Tours the Country

A fleet of "College of Cylinder Knowledge" mobile units are now being put on the road by Miller Motor Company of Chicago, to give valuable knowledge on the proper use, maintenance, operation and test of air and hydraulic cylinders in order to obtain the greatest possible efficiency and service life.

The new fleet is the result of the remarkable success of the original "College", a converted luxurious house trailer which is still in service. The new units are converted buses that require no towing and are easily driven, operated and maintained by one man with much greater economy. The bus exhibits, of cylinders in actual operation, are designed to instruct visitors. How to obtain leakproof operation and how cylinder users and buyers may quickly and easily test cylinders at almost negligible cost before installation are just two of the worthwhile "eye-witness" demonstrations to be seen.

The fleet of "Mobile Colleges" are rotated among company representatives so that each man has use of a unit for weeks at a time during which he drives the unit right into or near industrial plants by prearranged appointments and, as the "College Professor", demonstrates, explains, and instructs before visiting groups of design, engineering, production and maintenance men.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The Electrol
CHECK VALVE
That Prevents Reversal
of Flow in
AIR... OIL
OR WATER
APPLICATIONS
The Electrol (463FP) Check Valve is ideally suited for heavy-duty service applications — providing air, oil or water control lines with a minimum of pressure drop, and positive sealing against return flow. It has a maximum operating pressure of 5000 P. S. I., with a cracking pressure—in free flow direction—from 2 to 8 P. S. I. Elements are of brass and bronze—and include a patented O-ring check seat. Let us have a blueprint so we can work with you in adapting this Check Valve to meet your specific requirement. Your inquiry will receive prompt attention.
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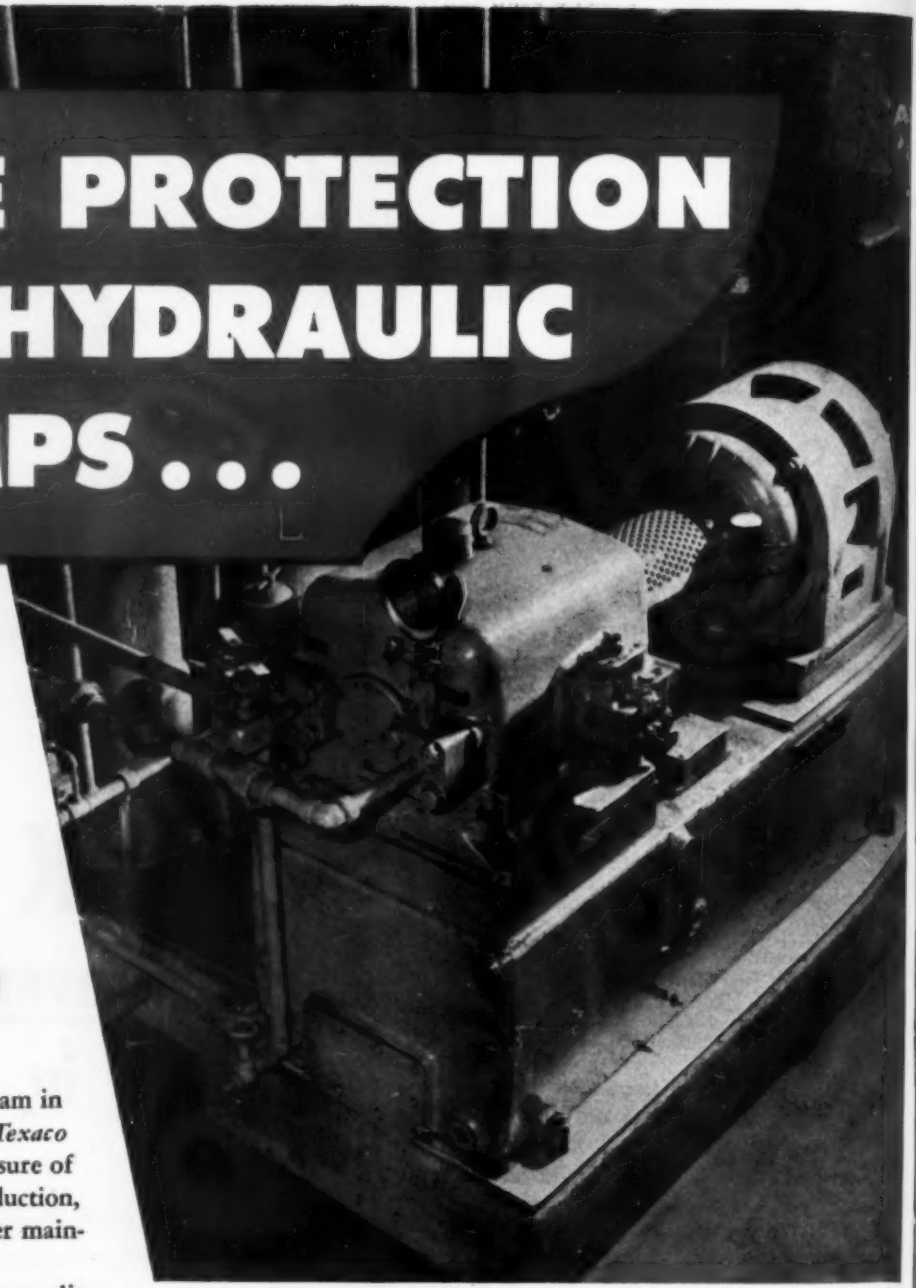
POWERPAKS • LANDING GEAR OLEOS • SOLENOID
VALVES • ON-OFF VALVES • SERVO CYLINDERS • TRANSFER
VALVES • CUT-OUT VALVES • SPEED CONTROL VALVES

Circle 32 on Reader Service Card

TRIPLE PROTECTION FOR HYDRAULIC PUMPS . . .



. . . with TEXACO REGAL OIL (R&O)

You'll have no rust, no sludge, no foam in hydraulic systems when you use *Texaco Regal Oil (R&O)*. You can thus be sure of smoother operation, "non-stop" production, longer pump and parts life, and lower maintenance costs.

Texaco Regal Oil (R&O) is turbine-quality oil *improved* with special additives and processing. Tested against ordinary turbine-quality oils it shows *more than 10 times greater oxidation resistance,* and far superior rust preventing ability. It does not foam, assures superior protection against wear.

There is a complete line of *Texaco Regal Oils (R&O)* approved by leading hydraulic manufacturers. You can count on an oil that's exactly right for your equipment, whatever its size, type or operating conditions.

Photo courtesy The Oilgear Company

A Texaco Lubrication Engineer is the man to help you get the most from your hydraulic equipment. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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TEXACO Regal Oils (R&O)

FOR ALL HYDRAULIC UNITS

Faithfully yours 50 *for Fifty Years*

TUNE IN: Tuesday nights on television—the TEXACO STAR THEATER starring MILTON BERLE. See newspaper for time and station.

TEST BENCH built to perform functional tests on brake control valves and load tests on aircraft wheels. Flow tests, leakage, brake pressure, proof and burst pressure tests are all measured on the panel.

Design and Construction of a Hydraulic Test Bench

By R. E. Sanders

BUILDING a hydraulic test bench for use in a development lab requires considerable foresight to provide sufficient flow capacity, pressure range, outlets and space to fill the needs of many new projects which are sure to show up after the bench is built.

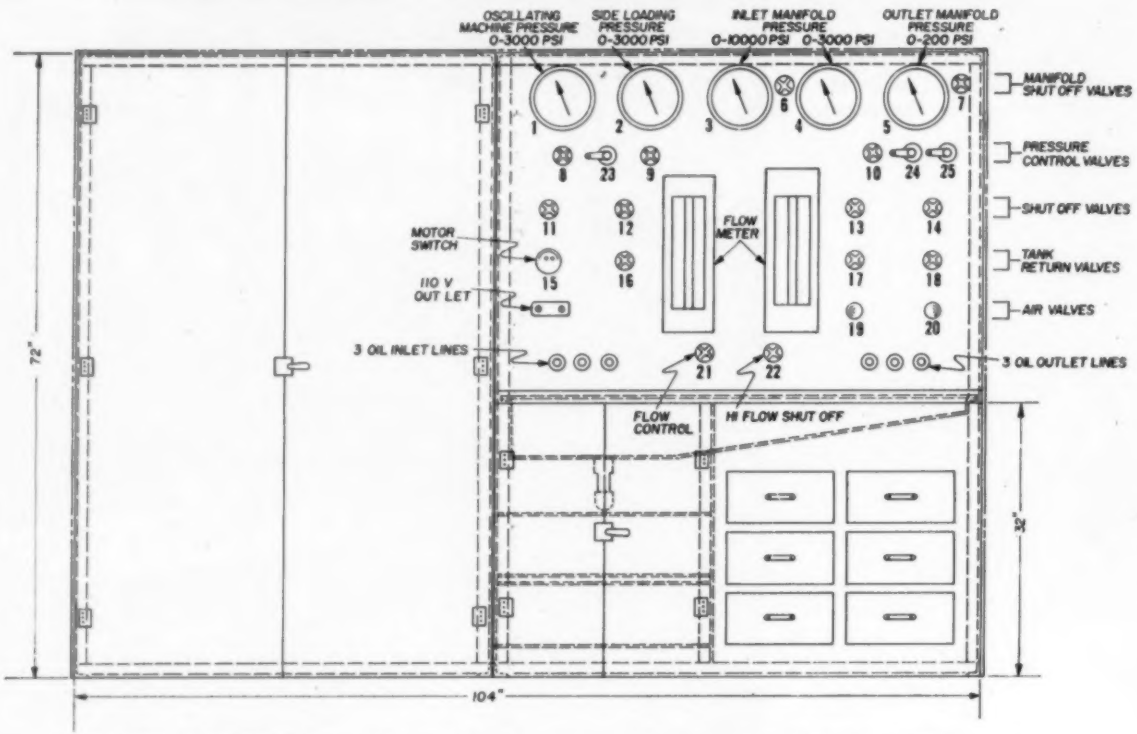
If the original decision to build a test stand stems from immediate test requirements in a development program, the designers should exceed these present needs and provide as flexible a test bench as can be built with the time and money provided for the project.

Details of the test bench built for the hydraulic laboratory at the Bendix Products Division of Bendix Aviation Corporation in South Bend, Indiana, are illustrated in this article. Our immediate requirement was to provide a test stand on which life cycle tests, pressure, capacity and leakage tests could be performed on aircraft brake valves. Also a special loading circuit for testing aircraft wheels was required.

The selection of a power unit of more than adequate size is the most important step in providing test facilities which will meet future needs. We chose a 50 horsepower package power unit which was purchased complete with a variable volume pump and electric drive motor mounted on a 110 gallon reservoir with relief valves and oil cooler. The pump can develop up to 5000 psi and be hand controlled to deliver from 0 to 20 gpm. For further flexibility and to reduce electric power consumption, we put in the circuit a 450 cu in, 3000 psi cylindrical piston type accumulator.

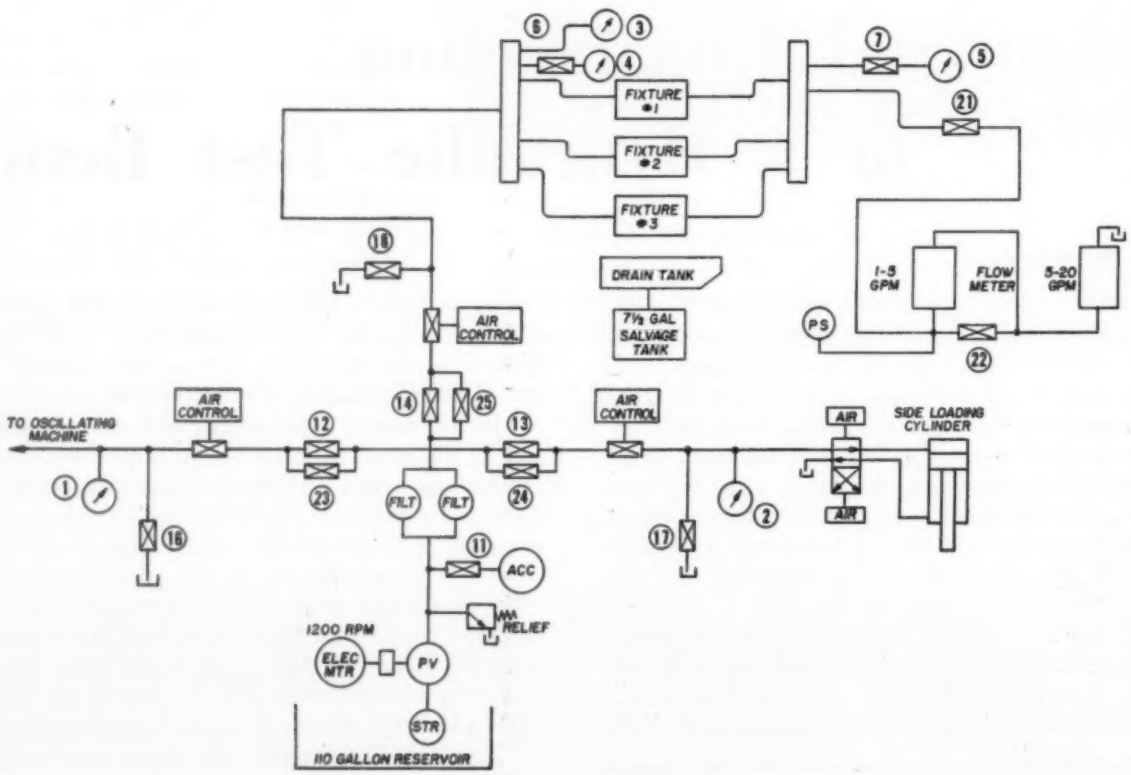
Our angle iron frame and sheet metal enclosure was built of sufficient size to facilitate any future cir-

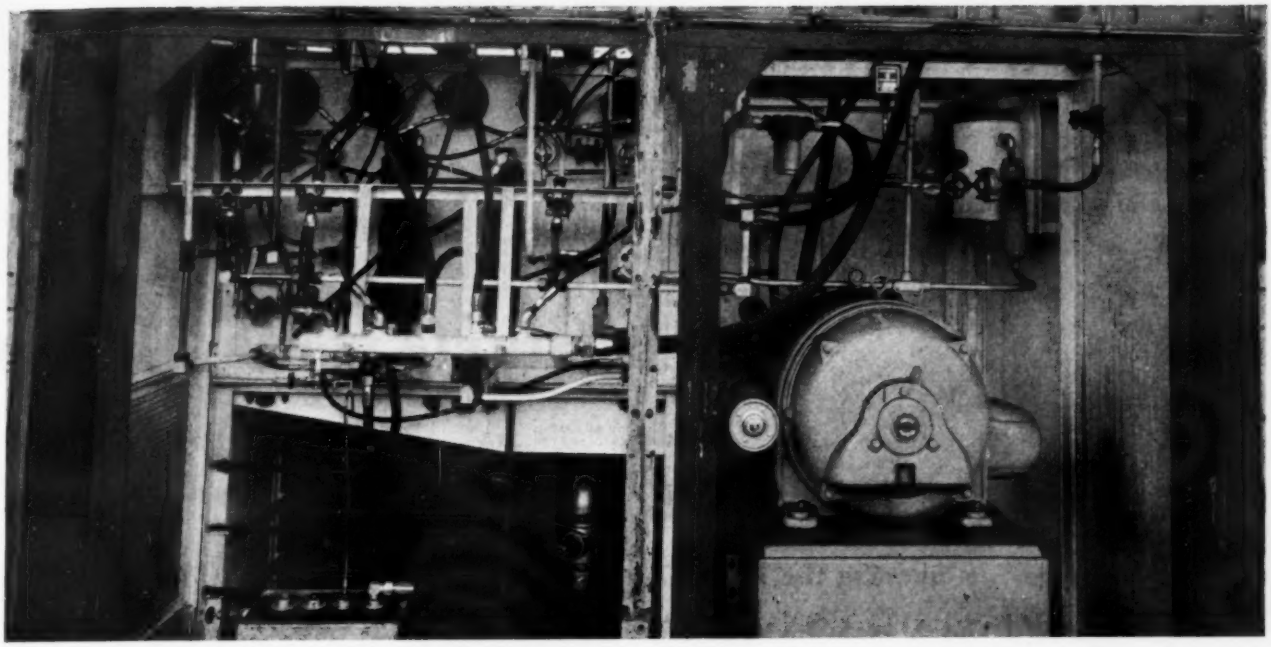
R. E. SANDERS, Bendix Products Division, Bendix Aviation Corporation, South Bend, Indiana.



PANEL LAYOUT shows the orderly arrangement of gauges and valves. Valves performing similar operations are all at the same level. Controls are easily reached and identified. Ample storage drawers and shelves are built into the test bench.

HYDRAULIC CIRCUIT for the test bench is drawn here using identifying numbers to correspond with the valves on the panel drawing. Plug valves are used for shut off; needle valves for flow control. Three air operated pressure control valves are used to regulate oil pressure to the oscillating machine, the side loading cylinder and the valve test fixtures. An air circuit controls the shifting of the 4-way side loading cylinder valve. Snubbers protect all the gauges.





REAR VIEW of the test bench shows the hydraulic and air hose connections. Medium pressure hose (1500 psi) is used on the return lines. High pressure hose (5000 psi) is used on the manifold to fixture connections and flow meter and pressure gauge hook up.

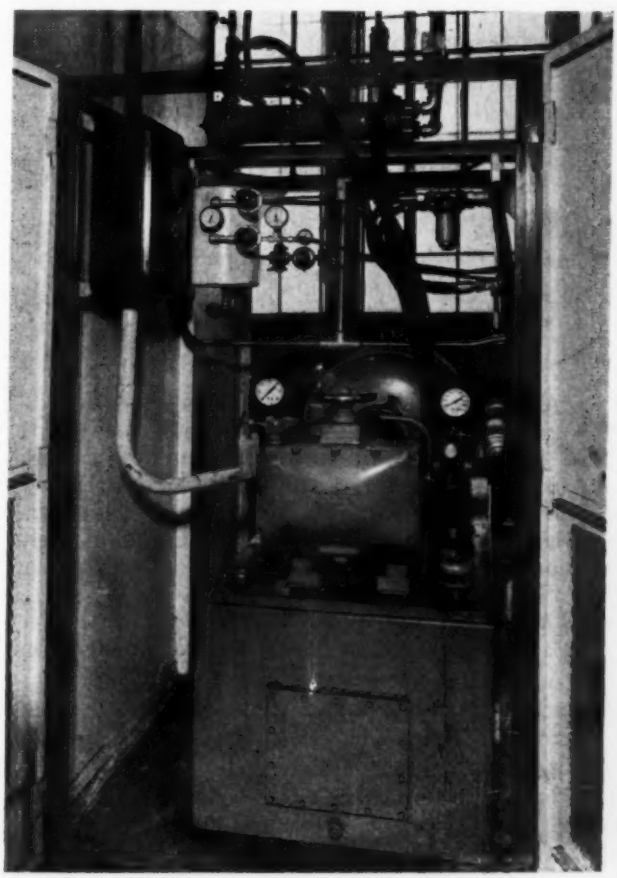
cuit maintenance or changes and to give a comfortable working area. The layout of the gauge and control panel was carefully made to group similar operations. For example, all return valve handles are at the same level, as are the handles for the shut off valves and pressure control valves. Controls directly related to the gauges are put adjacent to them. The panel layout drawing illustrates the final design showing provision for storage drawers and shelves.

The hydraulic circuit has three branches. One branch supplies oil to an oscillating machine which is not integral with the bench and is used for life cycling tests. A second branch supplies pressure to the three test fixtures which can be piped into the inlet and outlet manifolds on the bench. A side loading cylinder is supplied by a third branch. The circuit drawing shows the valving arrangement and the gauges used in each branch.

Each branch has a shut off valve, a flow control valve and a pressure regulating valve. The opening of each pressure regulating valve is controlled by air pressure on a control cylinder which is integral with the valve. Shop air is piped to the bench to control these valves and to operate the air circuit which controls the positioning of the 4-way hydraulic valve in the side loading cylinder circuit. Air operation offers effortless and extremely accurate control of hydraulic pressure in each branch of the circuit.

A low volume 1 to 5 gpm and high volume 5 to 20 gpm flowmeter are connected to the outlet manifold. An electric pressure switch having a 0 to 60 psi range protects the flowmeters from any damage which may be caused by high pressure. The switch is tied into the motor control circuit.

HYDRAULIC POWER UNIT is in the cabinet at the left of the bench. A variable volume 500 psi pump driven by a 50 hp electric motor is used. The air surge tank and regulator valves for the air circuit are at the upper left side. A tube type oil cooler is mounted on the top of the cabinet frame.



You Can Enter the

PRIZE PAPER CONTEST

Which Starts This Month

Procedure for entering the Prize Contest is very simple. Write to APPLIED HYDRAULICS PRIZE CONTEST EDITOR and ask for an Entry Blank. Suggestions and rules of the Contest will be promptly forwarded with the Entry Blank.

THE APPLIED HYDRAULICS PRIZE CONTEST is the first such contest conducted by this magazine. Its purpose is to stimulate new and wider applications and installations of hydraulic and pneumatic components and their circuits on industrial equipment. Incidentally, the Contest will give recognition to the key men and organizations responsible for the design and development, application and installation, operation and maintenance of machines and equipment actuated and controlled by hydraulic and pneumatic units.

A total of $1200.00 in prizes are offered. A grand first prize of $500.00 will be awarded to the contestant submitting the best paper. A second prize of $300.00, a third prize of $200.00 and fourth, fifth, sixth and seventh prizes of $50.00 each, complete the cash awards.

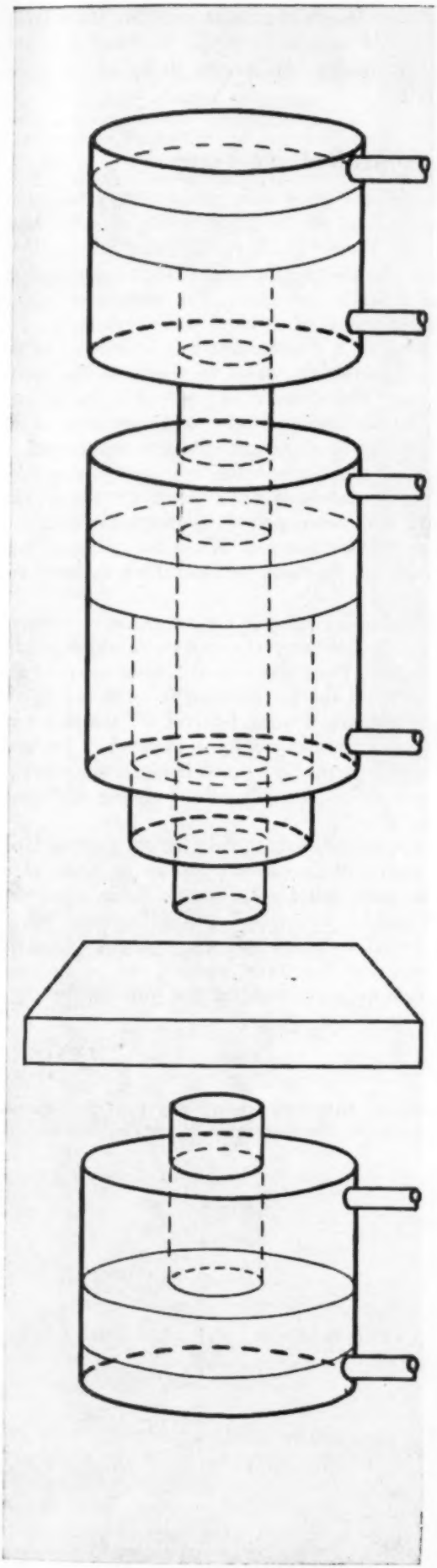
Contestants may choose any phase or subject on the design, application or maintenance of hydraulic or pneumatic components, assemblies and systems for industrial equipment. For example, the case history of a hydraulic valve, designed for an automatic high pressure circuit for an original equipment manufacturer might be selected. Or the application of an air or hydraulic circuit to a special purpose machine, involving an analysis of the machine specifications, choice of hydraulic or pneumatic components, piping, electrical controls and instrumentation would be a good choice. Since the operation and care of hydraulically actuated and controlled machines and equipment is of critical importance, another suggestion for a pertinent paper would be the setting up of a maintenance program.

Contestant may prepare papers individually or on a co-author basis. Any one except manufacturers of hydraulic or pneumatic components, units or assemblies and their direct representatives are eligible to compete.

Three outstanding authorities in their fields have agreed to act as judges.

A special group of Student Prizes will also be offered. The student awards are: First Prize $150.00; Second Prize $100.00; and Third Prize $50.00. Senior undergraduates as well as graduate students and co-operative students (part-time employment in industry) in recognized engineering schools are eligible to compete. Details for the Student Prizes are being sent to the Deans of a number of leading engineering schools.

The Prize Contest will close on June 1, 1953. All papers will also be considered for publication in APPLIED HYDRAULICS.



Hollow Rod Cylinder Design

for triple action riveting press

By D. C. Thomas

RIVETED assemblies usually require at least three operations:

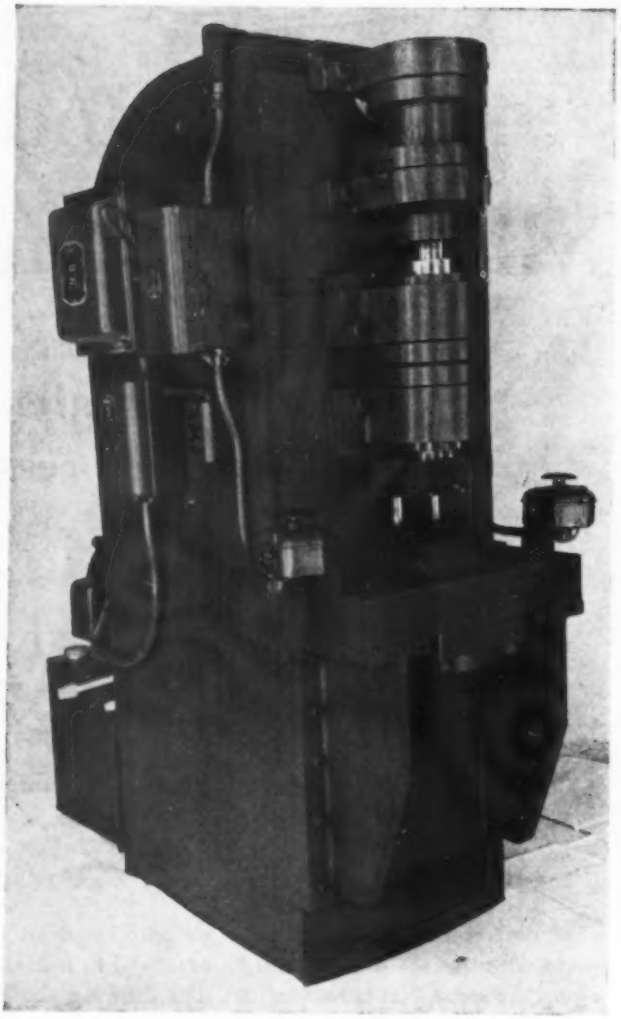
1. Clamp the work
2. Back up the rivets
3. Form the rivet heads

If the riveting operation is to be performed on a press, all three operations must be arranged to operate along the same vertical centerline. The drawing shows how three hydraulic cylinders are arranged along the same centerline to rivet lamination assemblies in the plant of the R-B-M Division of Essex Wire Corporation. The special press designed by TEC Engineering Corporation, Logansport, Indiana, has a center clamping cylinder with a hollow piston rod through which the rod of the upper rivet back up cylinder moves.

The riveting cylinder, which operates last, is located below the work platen. Each of the three cylinders have a one inch stroke. The clamping and riveting cylinders have a 4½ inch bore; the rivet back up cylinder has a 5 inch bore.

Sequence of operation is controlled by a simple electric and hydraulic circuit. Operating the solenoid valve through the two push buttons will first move the center clamping cylinder downward compressing the laminations. Next, a sequence valve opens to permit the upper or back up cylinder to travel down with its piston rod exending through the hollow piston rod of the center cylinder. The top piston rod backs up the five rivets through suitable pins in the clamping die attached to the rod of the center cylinder. Next, through another sequence valve the bottom cylinder comes up and forms the rivet heads on the underside of the assembly. A pneumatic timing relay is set

D. C. THOMAS, TEC Engineering Corp., Logansport, Indiana



THREE CYLINDERS are mounted in line on this riveting press. Pressing both palm buttons starts the triple action cycle.

for a sufficient length of time to complete these three operations, and then reverses the four-way solenoid valve for a simultaneous return stroke of all three cylinders.

Valve Controlled By Timer

A low pressure relief valve set at slightly over 100 psi takes the load off the pump during standby after the upstroke. Three ½ inch needle valves are provided to permit disconnecting any one of the three cylinders for other possible operations. The electric circuit is so arranged that both buttons will have to be depressed to start a downstroke, and both have to be released to permit the press to return to the starting position. Therefore, it is impossible for an operator to tie one button down, as some are prone to do to save time while disregarding safety regulations.

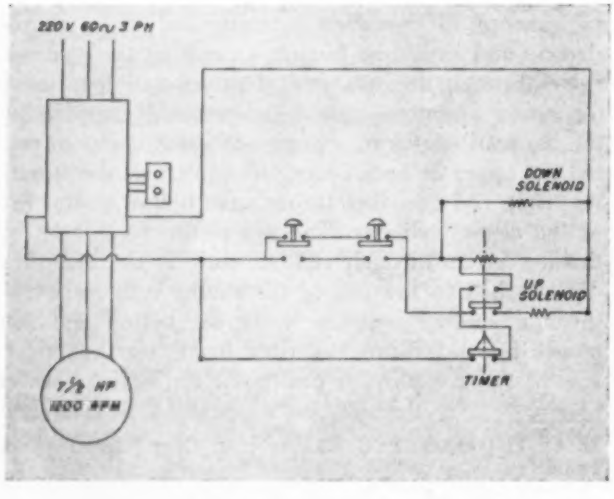
Shifting of the two position four-way double solenoid valve is controlled by a pneumatic timer. The adjustable time delay period is obtainable after energization of the timer coil. When the two start buttons are pressed the timer coil and down solenoid are energized.

After the timing interval the air pressure actuated diaphragm in the timer changes the position of the timer contacts. The timer coil and down solenoid are deenergized and the up solenoid is energized to return the cylinders. Timing interval for the timer on this press can be adjusted for a cycle of .2 sec to 3 min. For this particular riveted lamination assembly, the press is set up for a six second closing and opening cycle.

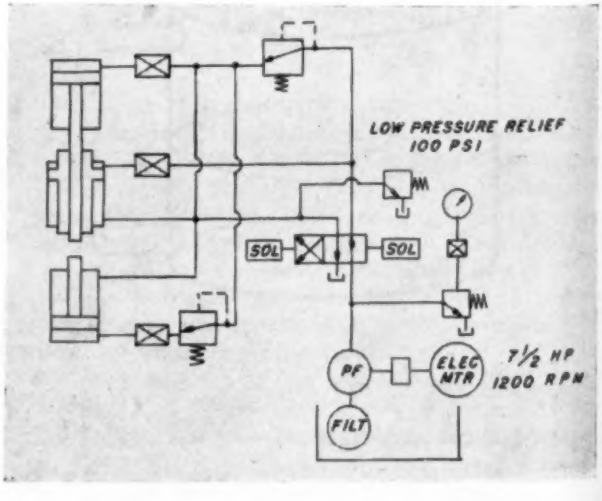
The press is designed to give a 10 ton riveting load. A vane pump which can develop up to 2000 psi is used. The main relief valve setting limits maximum pressure buildup to approximately 1200 psi.

Any riveted assembly having dimensions within the press platen size and throat opening can be made on this press merely by changing the working dies.

PNEUMATIC TIMER is set to return the cylinders after the riveting operation. The time delay is obtained after energizing the timer coil.



HYDRAULIC CIRCUIT shows the use of sequence valves to control the movement of each cylinder.



MILLION POUND testing machine, installed in 1879, had the original hydraulic Emery cells replaced by cells of improved design. An intricate, manually balanced, lever type weighing unit was replaced by a modern load indicator and control cabinet. When the test specimen is loaded in tension or compression the four hydraulic load cells are squeezed. The resulting hydraulic pressure is transmitted to the new null-balance indicator with a big dial in the control cabinet providing three load ranges.

Modernizing a 72 Year Old Hydraulic Test Machine

TODAY at the Watertown Arsenal, Watertown, Mass., a 72 year old testing machine of a million pounds load capacity, the first to have both hydraulic loading and independent hydraulic load transmission to balance scales, is entering the second phase of its long life.

The "United States Testing Machine", as it was long known, has been rejuvenated by four new Emery hydraulic load cells of latest design and a new control system with a three range load indicator dial. The electric motor driven oil pump in the control cabinet replaced accumulator type hydraulic equipment occupying 200 square feet of floor space.

Designed and built in 1879 by A. H. Emery, the basic machine is the same today. Two of its original outstanding and unique features are still features of testing machines being built today. These are the hydraulic load cells and the use of flexure bars or plates where very small movements are necessary.

The hydraulic load cell is basically a shallow cylinder having a loose fitting piston and a metal diaphragm so arranged that the load on a test specimen must pass through a thin film of liquid trapped between the diaphragm (backed by the piston) and the bottom of the cylinder. Piston movement is, of course, almost negligible. A bridge ring which supports the

PIPING is supported like a pantograph above the machine to allow movement of the loading cylinder. The hydraulic power system is housed in the base of the indicating system control cabinet.

diaphragm over the clearance space between piston and cylinder, and centers the piston so that it does not touch the cylinder wall, is the only significant change in Emery cell design since 1879. This change has lengthened the life of the diaphragm.

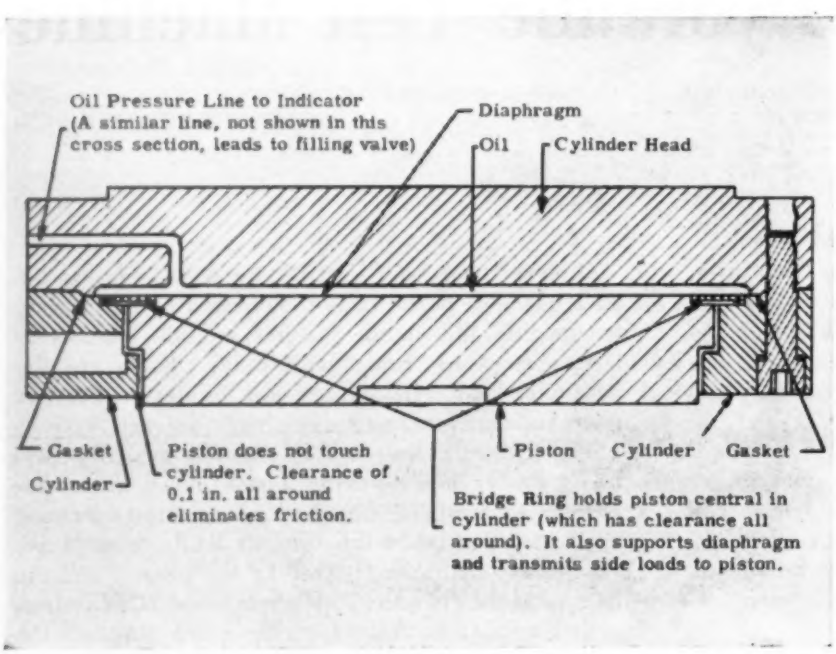
The loading cylinder and one set of specimen grips travel on rail carriages driven by a keyed gear that slides on a horizontal shaft near floor level. Gear trains turn four nuts on the two horizontal screws, thus positioning the grips and loading cylinder to suit the length of the test specimen.

A double acting piston in the loading cylinder has a 20 inch diameter head and 10 inch diameter piston rod forged in one piece, thus providing 800,000 pounds in tension and a little more than 1,000,000 pounds in compression with oil at 3400 psi. It has a 24 inch stroke applied up to one inch per minute. Hydraulic pressure is delivered to the loading cylinder through piping supported like a pantograph above the machine to allow movement of the loading cylinder. Hydraulic fluid, originally sperm oil, flows through four 1/16 inch diameter ducts in pipe that has an outside diameter of one inch. Three pipes are connected on the carriage and the fourth to the stationary grips. Grips may be applied hydraulically with a force of 1,000,000 pounds if required. Gripping pressure is indicated on the left hand dial of the new indicator cabinet by means of a precision type Bourdon gage.

Oil Hydraulic Package Housed In Control Cabinet Base

Along with the indicating system, the new control cabinet contains the oil reservoir, a radial piston motor driven pump, relief valve, flow control and unloading valves. To compensate for any variation in resistance against the ram, any leakage past the main cylinder packing and any internal pump leakage, a differential device varies the pump displacement thereby maintaining a constant ram speed.

The differential device is essentially a two chamber unit separated by a flexible diaphragm. One chamber is connected to the pump oil pressure, and the other side to the cylinder oil pressure. Any change in pressure in the cylinder or in the pump will result in movement of the diaphragm. Since the diaphragm is connected to the pump plunger, this movement will vary the eccentricity of the pump and hence its displacement, thereby tending to equalize the forces against the diaphragm.


Oil Pressure Line to Indicator
(A similar line, not shown in this cross section, leads to filling valve)
Diaphragm
Oil
Cylinder Head
Gasket
Cylinder
Piston does not touch cylinder. Clearance of 0.1 in. all around eliminates friction.
Piston
Cylinder
Gasket
Bridge Ring holds piston central in cylinder (which has clearance all around). It also supports diaphragm and transmits side loads to piston.

CROSS-SECTION of the Emery hydraulic cell shows the present design which has better support for the diaphragm than the hydraulic cells originally built for the testing machine 72 years ago. Oil pressure from the cell actuates a Bourdon tube pressure gauge on the new control cabinet.

TWO HORIZONTALLY opposed two spindle drill units drill lightening holes in tractor crankshafts. Each drill spindle is fed hydraulically by a separate package pump unit which is belt driven from the electric drive motor. The machine is wired for automatic cycling or may be manually controlled from the push button station.

Packaged Feed Reduces Piping

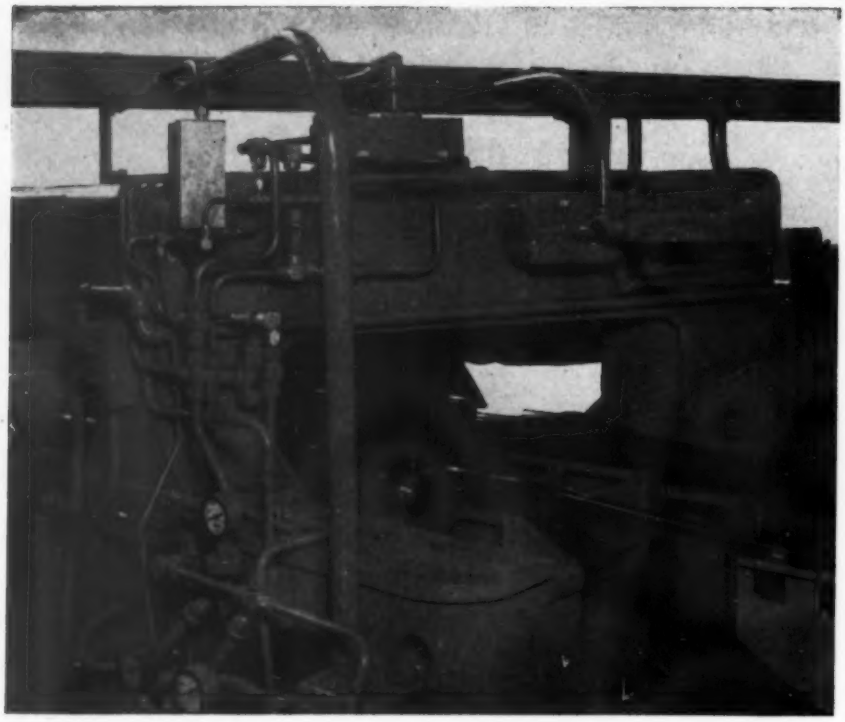
By Larry Ninneman

WHILE the circuit design of hydraulically fed drilling machines is greatly simplified by the use of packaged units which combine the control valves with the pump, the most important gains are to the machine user. His maintenance of equipment is reduced and oil leakage is minimized.

Built by Baker Brothers, Inc., of Toledo, this special machine drills the 1 inch diameter lightening holes through the crank pin bearings of tractor crankshafts. The machine is a four station transfer type with a tunnel type fixture and two horizontally opposed two spindle drill units. Cyclic operation is completely automatic, the operator being required only to drop the crankshaft in the load station during normal operation. For set-up purposes, the machine functions may be separately controlled from a pushbutton panel at the load station.

The tool slides on the machine are controlled by separate pump units mounted near their respective cylinders. The pumps are comprised of a fixed volume low pressure gear pump to furnish the rapid traverse oil requirements, a variable volume radial piston pump to furnish the feed volume at pressures up to 1000 psi depending upon the feed requirements, and an integral double solenoid 4-way valve for controlling the direction of oil flow. This is an extremely compact unit and reduces external piping to a minimum, the only two lines being those going into the cylinders. All pressure control valves are contained right within the pump housing and therefore require no additional piping. With this pump it is possible to

LARRY NINNEMAN, Hydraulic Engineer, Baker Brothers, Inc., Toledo, Ohio.



SOLENOID OPERATED VALVES which control the transfer and clamp cylinders are mounted on the machine frame directly under the electric bus bar. All electrical connections to valves and motors are simplified by having a horizontal bus bar running the length of the machine.

preset fine and coarse feeds over a range of 20:1.

The valving arrangement in these pumps permits recirculation of the oil to the sump under 10 psi pressure during idle slide unit time which results in low operating temperatures and a less bulky reservoir. During the feed portion of the cycle, the gear pump oil is vented at 10 psi to the reservoir and also supercharges the piston pump intake.

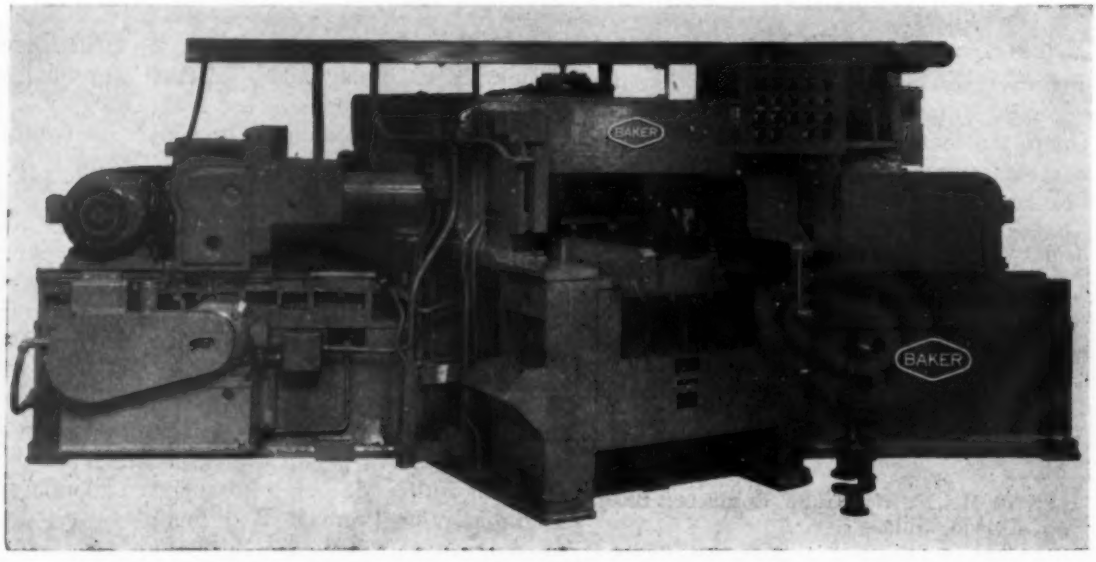
For the purpose of operating the transfer and clamping mechanisms, a third pump unit was supplied with the proper valves so that the machine could be completely automatic.

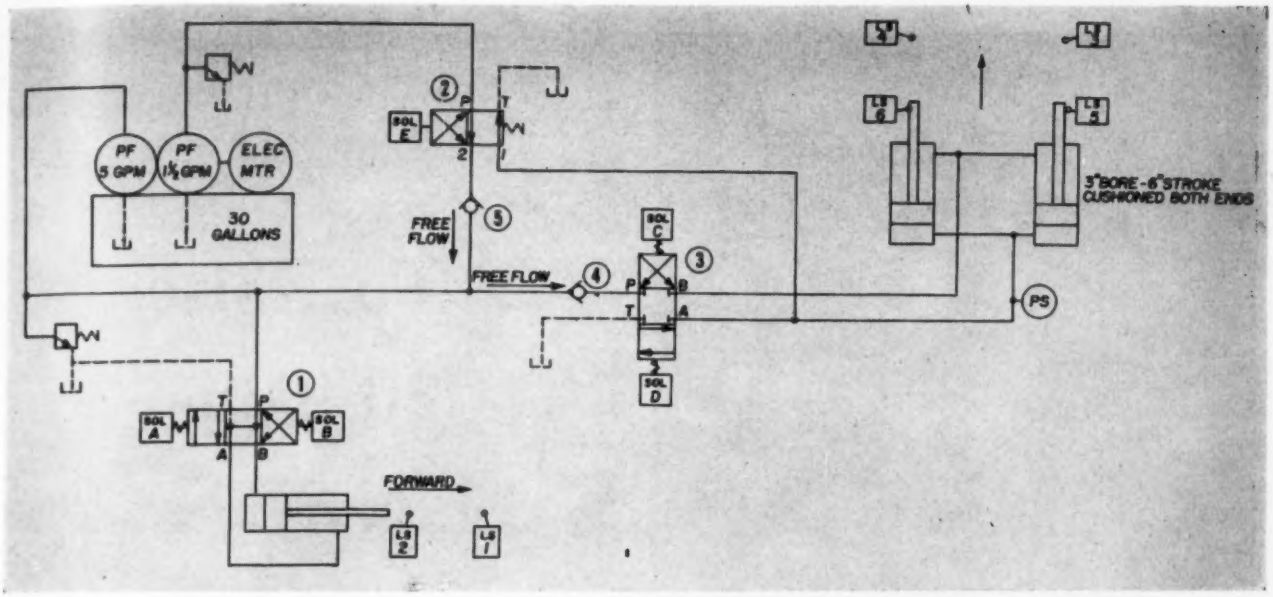
The pump selected is a double pump with individual pressure relief controls, one pump supplying 5 gpm and the smaller one, 1.5 gpm. All solenoid valves are the directly operated type.

Reduce Generated Heat

In order to use a smaller large volume pump for the rapid traverse portions of the cycle, the circuit was so designed that the volume of both pumps could be delivered to any of the cylinders.

ELECTRICAL CONTROL relays and timers are panel mounted in the enclosure at the right of the drilling machine. The right hand drill feed package pump and double pump unit for the auxiliary clamp and transfer circuit are seen in this view.





VALVING FOR the transfer and clamp circuit makes possible the delivery of both pumps to any of the cylinders during the rapid traverse portions of the cycle. Operating sequence is controlled by six limit switches, a pressure switch and associated timers.

When all valve coils are deenergized, the volume of both pumps is vented to the sump under no pressure through valve 1. This was done so that the generation of heat would be held to a minimum and consequently a smaller tank occupying less floor space could be used.

Sequence of Operations

When the operator has a new crankshaft placed on the transfer rails at the load station, by depressing a pushbutton, he causes solenoid B of valve 1 to be picked up thereby directing the combined volumes of both pumps to the transfer cylinder which moves the crankshaft to the first drill station. As the transfer rail moves forward, LSI will be tripped picking up a timer which is used to make sure the transfer rail is in position against a positive stop. When this time period has expired, solenoid E of valve 2 and solenoid C, valve 3 are energized, to direct the combined volumes of both pumps to raise the part and clamp it.

Limit Switch Operation

Check valve 5 prevents any oil flow from the large pump from being vented to the tank through valve 2 which has been shifted to deliver oil from the small pump through ports P to 1 to the blank ends of the clamping cylinders. When the parts are moved to a clamping position, limit switches LS 3 and LS 4 will be tripped indicating that the parts are raised and when sufficient pressure has been built up to trip the pressure switch, solenoid B and solenoid C will be dropped. The latter isolates the clamping cylinders from the large volume pump. At the same time, solenoid B and C are dropped, the signal will be given for the tool units to advance and solenoid A will be energized to return the transfer rail to the load station to receive a new part.

When LS 2 has been tripped, valve 1 is dropped to neutral which vents the large volume pump to sump at no pressure.

The vertical load on the transfer cylinders makes it imperative that the switchover from traverse to clamping be instantaneous in order to prevent any dropping of the part and consequent unclamping. Check valve 4 prevents any reverse flow when the two valve coils are dropped.

By-Passing Oil Leakage

Another reason for connecting line 1 of valve 2 between the valve and the clamping cylinders is to discharge to tank any oil leakage through valve 3 that would otherwise lift the part when the clamping cylinders are down and consequently jam the transfer.

When the tool slides return to their rear depth position after machining the part, solenoid A and solenoid D are energized, solenoid E is deenergized and the part is thereby unclamped and lowered to the transfer rails.

In automatic operation, when the unclamped part trips LS 5 and LS 6, a new part will immediately be transferred in, but when in hand operation, they will simply drop all solenoids and vent both pumps to tank.

When the part is transferred from work station 1 to station 2, it is mechanically rolled 180 degrees to permit drilling the next 2 holes, in the proper spot. At the unload station the parts are set on an inclined rack that will hold approximately a dozen crankshafts and also roll them out of the machine.

ONE OF THE 11 foot stroke rams for use on a steel sheet piler is being moved into the plant for installation.

To Raise 20 Tons Eleven Feet ...

RAISING 40,000 pounds of sheet steel through a stroke of 11 feet requires the design of a large capacity hydraulic power unit. The Weinman Pump and Supply Company of Pittsburgh designed and built this sheet piler for the new Fairless Works in Morristown, Pa.

Two complete power units are mounted on a 1100 gallon oil reservoir. Each 300 gpm, 250 psi pump is powered by a 50 hp a.c. polyphase motor through a flexible coupling.

The 17¾ inch bore vertical cylinders are designed to lift a sheet piler 6 feet wide by 15 feet long, capable of handling the 40,000 pound load. The arrangement shown in the schematic permits powering each pair of cylinders by either of the pumps or using one pump for both pairs of cylinders. In case of a shut down of one power unit, the second unit would be put in operation. Hand valves in the discharge line permit quick cutting in or out of either pump.

On-off, two way, normally closed solenoid operated valves are used for raising and lowering the piler, and normally open valves are used for unloading the pumps. All operations are controlled from a remotely located station. Limit switches, tripped when the rams are in the down position, deenergize the unloading valve solenoid to open the valve and dump the pump volume to tank at no load pressure.

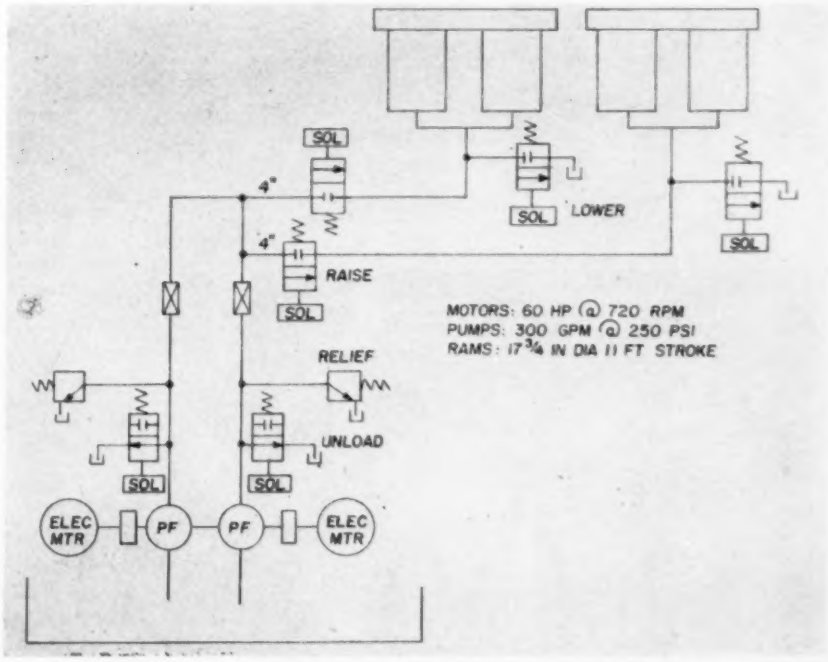
Because the rams are single acting and two way valves are used in the raising circuit, another two way valve is used to permit oil to drain from the ram back to tank as the rams lower by gravity.

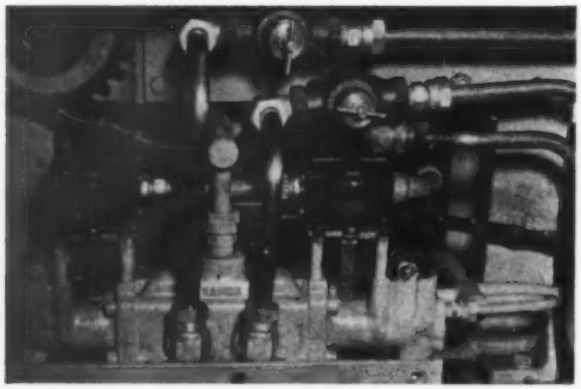
To carry the 300 gpm at safe fluid velocities, 4 inch pipe with flanged connections is used.

With one 300 gpm pump supplying a pair of these large cylinders, it is possible to raise the rams through the 11 foot stroke in about a minute.

EACH OF THE two pumps has a capacity of 300 gpm at 250 psi pressure and is equipped with solenoid operated unloader, solenoid valves for raising and lowering and two large diameter vertical single acting cylinders. Installed at the new Fairless Works in Morristown, Pa. to power a sheet plier, this power unit includes two 50 hp a.c. polyphase motors. Both power units are mounted on a 1100 gallon reservoir. Four inch piping with flanged connections carries the high volumes at safe fluid velocities.

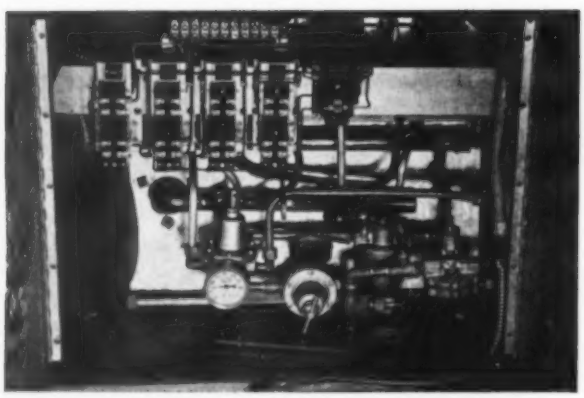
CONTROL VALVES in this sheet piler circuit are electrically actuated to permit push button control of the rams from a remote station. Limit switches tripped at the bottom of the ram stroke open the unloading valves to dump pump volume to tank at no load pressure.

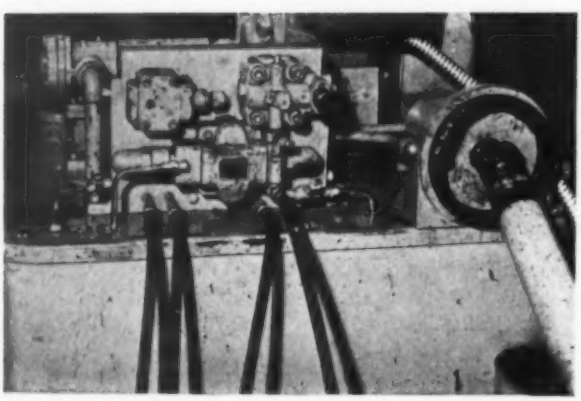




A Basic Approach to Hydraulic and Pneumatic Design Problems

By Charles H. Hallet and
Elmer F. Heiser





When you ride along as a passenger in an automobile you are often amazed, impressed or even terrified by the driver's approach to problems. On a stretch of well-known road he usually chooses to avoid or hit different bumps than you would. Going from point "A" to point "B" in the city it always seems that the fellow who drives has another idea as to the best route. Actually the best route between any two points would vary with conditions such as the time of day, the weather, road conditions, ball game or convention crowds, activity of traffic cops, etc., etc., etc.

A PROBLEM relating to the application of air or hydraulic equipment could be stated with a simplicity approaching the "A" to "B" points mentioned above. For example: As part of a machine function, equipment to be developed requires 10,000 pounds through a travel of ten inches in ten seconds. Each time these or similar specifications turn up the "best route" will vary depending on many conditions.

There is no point-by-point procedure which can be followed as a guide to reach the best answer to any and every air or hydraulic problem. This article makes no attempt to establish a "route" to successful design but merely covers some of the more important considerations which should enter problem analysis.

CHARLES H. HALLET and ELMER F. HEISER, sales engineers, S. G. Morris Co., Cleveland, Ohio.

A clear understanding of the basic problem is the primary requirement. This preliminary information may be divided into two categories.

1. General Information

(a.) Type of machine—ie., press, grinder, etc.
(b.) Is installation to be an entirely new job or a revision to old equipment.
(c.) Type of control required
manual—automatic—semi-automatic

2. Specific Information

(a.) Cycle of sequence of operations
A chart or diagram is advisable showing all motions and the sequence or order of their operation.
(b.) Speed
Sometimes this must be "as fast as possible" but where a number of motions are involved and speeds are specified they are filled in on the diagram.
(c.) Loads or forces
The known loads or required forces are added to the diagram.

We should now have a chart or diagram which presents a clear statement of the problem. It would be unwise to start at this point determining pump capacity, cylinder and valve sizes or types or otherwise jump to conclusions. Actually the information so far charted provides only an indication of the direction or "route" to follow for the answer.

Following are further analysis steps which should be considered between the preliminary statement of the problem and the final design and selection of equipment.

These are variables from job to job and no definite sequence or order is intended, in fact very often many of the points are answered without special attention.

3. Purpose of machine and product involved

Not only should we know, for example, that we are adapting hydraulic equipment to a press but also what is the purpose of the press. We should find out as much as possible about what the press is expected to do and the product which is involved in the press operation. Although functions, speeds, forces, etc. of two presses may be similar, the design and selection of the hydraulic equipment can be widely different as determined by the product involved. For example, one press may be used to make or test concrete block where abrasive accumulations are a major problem while another may be used in a food, rubber or chemical plant where contamination from the machine to the work is a factor.

4. Related Mechanics

We chose this term "related mechanics" for want of a better description. It is never wise and seldom possible to divorce the air or hydraulic phases of a new machine from the mechanics of the entire design. In other words, it is a fallacy to attempt to develop, design or select the air or hydraulic components for any installation independently of the many mechanical factors which may be related or involved. This close relationship is particularly obvious on installations where accurate tool feeds may be involved or where the center of gravity may shift as on a tilting table, etc.

The column strength of cylinders may have to be considered. A small diameter cylinder with a small piston rod may be correct hydraulically in so far as force and speed are concerned. Mechanically it may be necessary to use a large rod with a resulting cylinder of large area to obtain column strength. Likewise a one inch diameter cylinder may give enough force to accomplish the required work but it may be necessary to increase the cylinder area considerably to obtain enough oil volume for fine feeding.

Speed of operation can become a problem and ties in with the mechanical design. Such factors as actuation time of solenoids, time lag for pilot operations, inertia of oil, valves, cylinders and mechanical parts, and problems of acceleration and deceleration should be considered. It may be possible to hydraulically operate a cylinder through a given stroke in a prescribed time but mechanically it may be impractical due to inertia and shock in related equipment.

In the few examples cited, any or all cylinders, pumps, valves, pipe connections, motors, reservoirs, etc. could be too large or too small or otherwise unsuited if selected purely on the basis of the preliminary statement of the problem. We believe we are safe in stating that of all factors involving the application of air or hydraulic equipment the proper consideration of so-called related mechanics is one of the most important.

5. Number of Units to be Considered

If only one unit is to be built the design thinking and equipment selection may be different than if a large number of duplicate units are to be made. Further your thinking may be conditioned by the destination or distribution of the units. If a number of units are to be built, all to be located in one department, in one plant, the design may be different than that selected for the same number of units scattered widely in various plants.

6. Environment

Is the machine to be used in a laboratory or a foundry? What about the general plant conditions—clean, dirty, etc? Where will it be located in the plant? Will it be adjacent to a source of heat such as an oven or furnace? Will it be located where temperatures may vary widely with weather changes.

In addition to the physical environment the human association is also important. Are maintenance and operating personnel familiar with this type of equipment? Is a competent electrician available? A simple system or circuit with solenoid valves and interlocks may be successful in one plant but completely hopeless in another.

7. Accessibility for Maintenance

It is well to keep in mind when designing that the time may come when repairs will be in order. Equip-

Continued on page 133

Design and Application of Flared Fittings

Part 5 of a series on Fluid Lines

By R. W. Phillips

Inverted Flared Fittings

The inverted flared fitting (Figures 1 and 2) is the standard fitting for almost all automotive fluid lines. Because of its use in the automotive industry, it is the most widely used of all flared fittings.

The fitting consists of two parts—a connector and a tube nut. The connector is internally threaded with a flare seat at the base of the thread. The seat has an angle of 42 degrees and is protected from damage in the internal thread above it. The nut forces the 45 degree flare of the tubing against the seat so that the flare of the tube is sealed against the seat of the connector. The nut supports the tube against vibration. Its length tends to prevent the stresses from being transmitted to the angle at the base of the flare and in that way increases the life under extreme conditions of vibration.

To assemble the fitting properly, the following procedure is used. The tubing is cut off and burred. The tube nut is placed in the tubing with the hex head of the nut away from the end of the tubing. The tubing is now placed in a flaring tool or flaring machine and flared to a 45 degree angle. The flare is double if a thin wall tubing is used for sizes 3 to 6 inclusive; single if heavy walled tubing is used. The flared tube is then placed in the connector (Figure 2) and pulled up to the torques listed in Figure 4.

When torque wrenches are not available, or desirable, the nut may be run down with a wrench until it just makes contact and an additional one-sixth turn then applied.

This fitting is one of the least expensive to make and it gives excellent service at pressures to 1500 psi under most conditions of pressure and vibration. It is particularly adaptable to the requirements of the automotive industry, The connectors are brass and the tube nuts are usually of steel. This combination gives good results; the steel nut in contact with the brass connector gives a lower torque in assembly with no galling, even when not lubricated. When steel tubing, such as Bundy, is used the tubing is harder than the seat and tends to deform it readily to produce a scar. The fitting can be used with any kind of flared tubing.

The connector is difficult to manufacture if it has to be made from steel. The seat cutting operation in steel results in rather high tool wear. This cost is the principal reason why relatively few such fittings are made from steel. In addition to the difficulty in machining, the deformation of the seat to produce a good seal is an added problem. The result is that

FIG. 1. Connector and tube nut of an inverted flare tube fitting, ready for assembly. The tubing has been flared to a 45 degree angle.

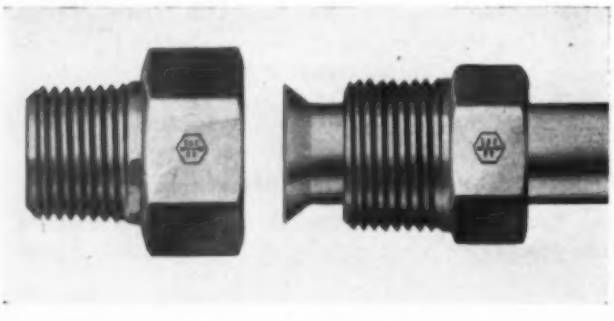
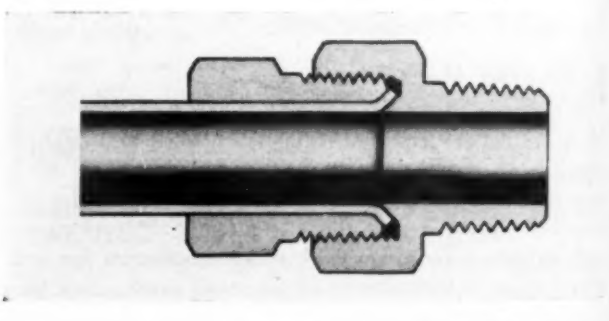


FIG. 2. Inverted flare fitting assembled. The tube is placed in the connector and pulled up to the recommended torque values (Figure 4).



Size	Dash No.	Thread
1/8	2	5/16-24
3/16	3	3/8-24
1/4	4	7/16-24
5/16	5	1/2-20
3/8	6	5/8-18
1/2	8	11/16-18
5/8	10	7/8-18
3/4	12	1 1/16-14

FIG. 3. Inverted Flare Fitting Sizes and Pitch of Threads.

Size	Half Hard Copper Tubing	Bundy Tubing
1/8	45 in/lbs	50 in/lbs*
3/16	55	70*
1/4	65	90*
5/16	80	120
3/8	125	175
1/2	250	350
5/8	350	450
3/4	500	600**

*Double Flared
**.035 1010 steel

FIG. 4. Torque Table for Inverted Flare Fittings.

very few steel fittings are used in general commercial practice.

The principal limitation of the inverted flare type of fitting is its over-lap in installations. The continued use of this fitting has shown that, if an installation is properly designed for the fitting, an overlap may be overcome to such an extent that it is not objectionable.

The inverted flared fittings are available in sizes to three-fourth inch and in most shapes. Figure 3 lists the sizes available and the pitch of threads used with the fitting. The standards for the various fitting shapes available as standards are shown in the latest issue of the SAE Handbook.

The Grinnell flared fitting, a two piece fitting using a 10 degree angle, is no longer available to the trade. It is mentioned here only because a number are to be found in high pressure service. The low angle has the advantage of producing high force with low torque and the disadvantage of requiring a longer flare, necessitating a special set of flaring tools.

Parker Triple (AC 811) Fittings

This fitting is the outgrowth of development work done at the Parker Appliance Company and is covered by patents controlled by that company. Prior to this fitting the Parker Appliance Company had developed a modification of the inverted flared fitting which was being used in aircraft and also industrially. This was called the 810 fitting. Because of some of the inherent difficulties of the 810 fitting, the 811 fitting was brought out. It became one of the fittings widely used in aircraft in the period 1930 to 1943.

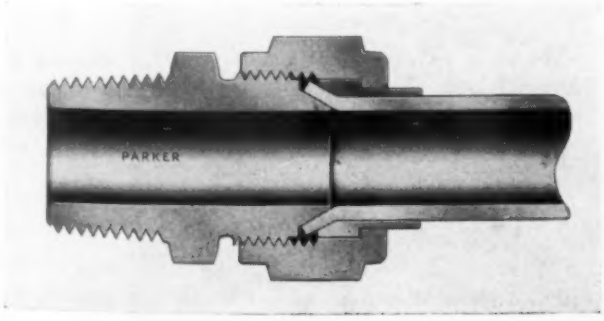
The fitting was designed with a cone shaped external nose for sealing rather than the internal cone found in the 810 fitting. It used a sleeve to support the flare, similar to the support found in the nut of the 810 fitting but differing in that the sleeve could remain stationary or move in assembly, thus helping to reduce the pile up of eccentricities and making more sealing pressures on the flare.

The fitting is a three piece fitting consisting of a tube nut, a sleeve, and a connector (Figure 5). The tube nut is threaded to pull the flare angle against the conical nose of the connector, which is also threaded. The sleeve supports the flare and the tubing giving the tubing good vibration characteristics and also good sealing characteristics. The flare angle is 30 degrees. The seat angle varies from 25 degrees to 37½ degrees.

The fitting is assembled as follows: cut the tubing to be used to length, square up the ends if necessary

Concluded on page 135

FIG. 5. The AC 811 (old style Parker Triple) tube fitting consists of a tube nut, sleeve and connector. In assembly the sleeve supports the flare, giving good vibration and good sealing characteristics.



Fitting Size	Tubing Size	Threads	Nose Angle	Flare Angle	Flare Diameter
2	1/8	5/16-24	37½°	30 degrees or same as nose angle depending upon flaring equipment available.	*Maximum*: equal to sleeve O.D. *Minimum*: equal to sleeve countersink diameter.
3	3/16	3/8-24	37½°		
4	1/4	7/16-20	35°		
5	5/16	1/2-20	25°		
6	3/8	9/16-20	30°		
8	1/2	3/4-18	30°		
10	5/8	7/8-18	30°		
12	3/4	1 1/16-14	30°		
14	7/8	1 3/16-14	30°		
16	1"	1 5/16-14	30°		
18	1 1/8				
20	1 1/4	1 5/8-14	30°		

FIG. 6. Table of Sizes, Threads, Nose and Flare Angles and Recommended Flare Diameters for the AC 811 Tube Fitting.

LOOKING DOWN at one of the sluice gates. It is six feet wide by five feet high; has rising stem; and weighs 2900 pounds.

High Pressure Hydraulics for Emergency Operation of Heavy Gates

THERE are three sluice gates between the intercepters and the main pumping station of the East Bay Sewage Treatment Plant, East Bay Municipal Utility District, California, which are normally open, but must be capable of being closed rapidly. If there were no provision for closing, a power failure would result in a flow of raw sewage which would flood the station.

These gates are six feet wide by five feet high; have rising stems; weight 2,900 pounds, each; and are designed for an unseating head of 20.75 feet of water. An additional gate of the same size is located between two sumps, but its speed of closing is not critical.

Comparison of Operating Means

Designers of the pumping station considered various rapid closing means. Hand operation was entirely too

A charged accumulator system and the use of battery operated solenoid valves assures closing of heavy sluice gates within 40 seconds after valve actuation by a float switch. This rapid closing system prevents flooding in the event of power failure on the sewage pumps.

slow, as maximum closing time was set at 1½ minutes. Electric motor operation from a standby generating plant could not close the gates in less than five minutes . . . after the standby plant was started. The thought of using compressed air was rejected because of the large size and high cost of the cylinders needed. A water hydraulic system presented corrosion problems, as well as unreasonably high installation and maintenance costs.

A high pressure oil hydraulic system was finally selected because of the ability to use smaller pumps, piping, accumulators and cylinders, as well as a considerably smaller gallonage of oil than would be required for a low pressure hydraulic system. Motor sizes would be practically the same for either type of system, but the figures indicated that the high pressure system would close the gates more rapidly.

The Rucker Company, Oakland, California, had worked with the pumping station designers in the preliminary planning of the oil hydraulic system, and was found to be the low bidder when estimates were opened. Its bid included the engineering and installation not only of the equipment for an automatic high pressure oil hydraulic operating system for the three inflow sluice gates, but also for a manually controlled high pressure oil hydraulic system to operate the gate between the sumps.

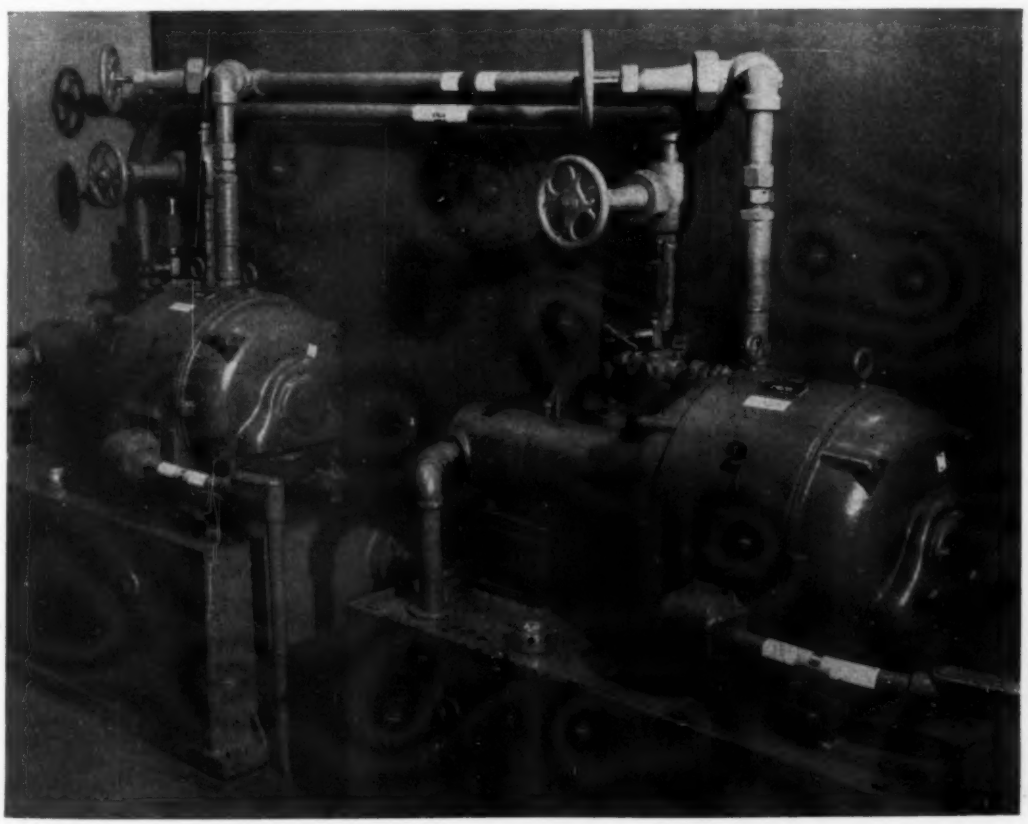
This latter gate, normally open, must be closed occasionally to permit servicing of the pumps and bar screens connected with either sump. Its oil hydraulic power comes from the same units and accumulators that operate the three inflow sluice gates.

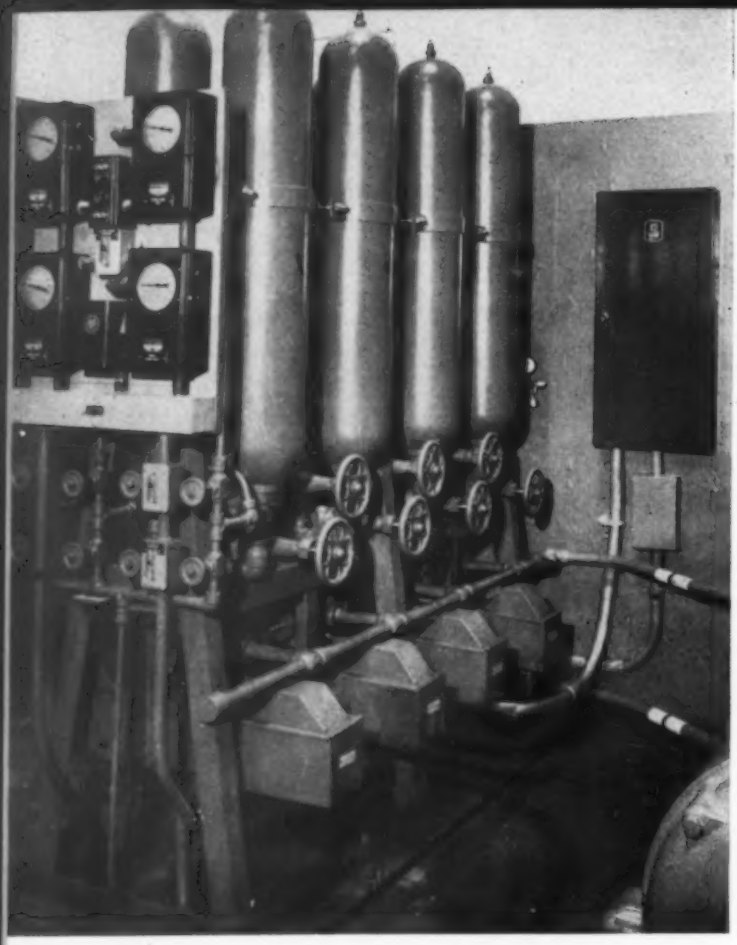
Two Power Units

Two power units are installed, one of them a standby. Each consists of a vane pump driven at 1,200 rpm by a 20 hp electric motor and capable of delivering 14.5 gpm at 1,250 psi from a 60 gallon oil reservoir.

The pumps discharge into eight cross-connected bladder type accumulators, each of 10 gallons capacity. Flow from accumulators to cylinders is through pres-

POWER UNITS which deliver 14.5 gpm and 1,250 psi each, to a battery of accumulators. One is for standby use. Notice that both electrical and hydraulic lines have identification conduit and pipe markers.





BATTERY of eight cross-connected accumulators, bladder type, kept charged at 1,250 psi, and able to operate all four sluice gates for two strokes and still leave a pressure of 675 psi in the system.

sure switches, flow control valves and double solenoid directional control valves.

Three Automatically Closed Gates

The solenoid control valves for the three inflow gates operate to close the gates automatically when a float rises to a predetermined height in the sumps. The circuits can also be manually operated for tests and sump isolation. Control of the gate between sumps is through an identical solenoid valve which is manually operated.

All four gates are opened by means of manually operated control valves located on a control board adjacent to the main pump motor controls.

Battery Current Operates Solenoids

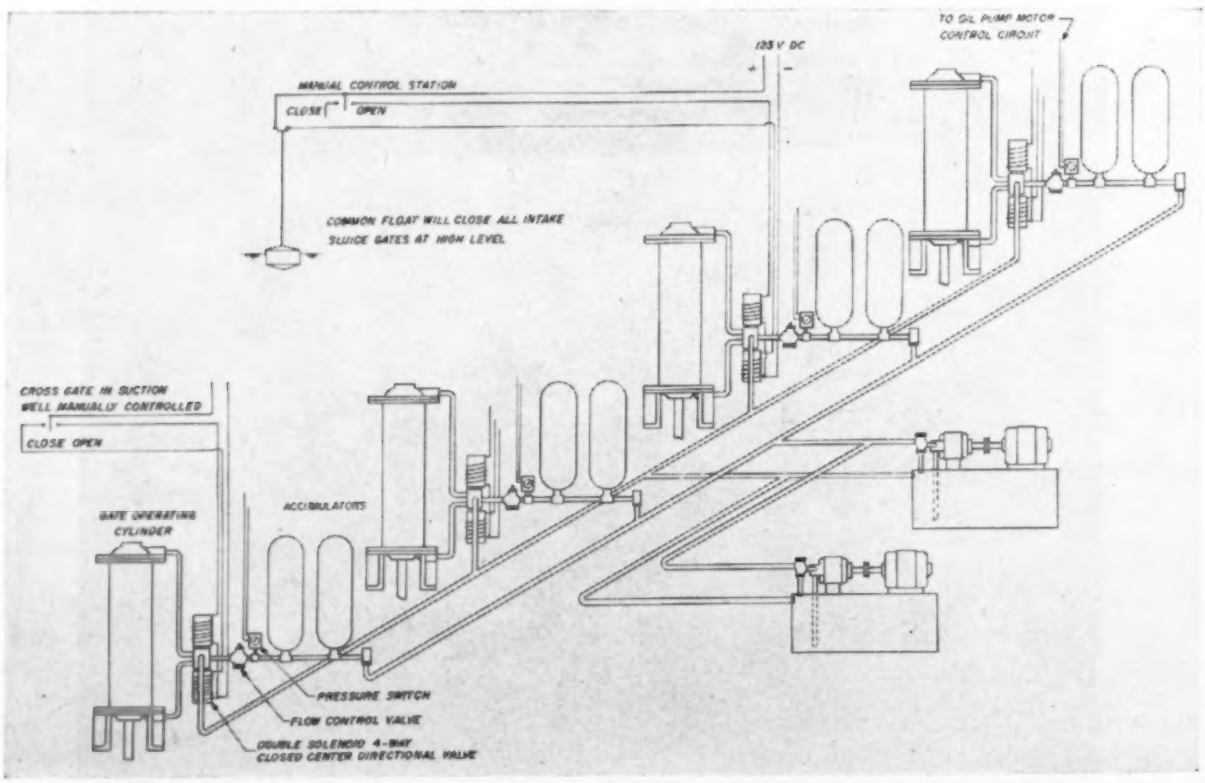
Solenoids are operated on 125 volt current from a storage battery. This battery also provides current for light in case of power failures, and operates the main circuit breaker.

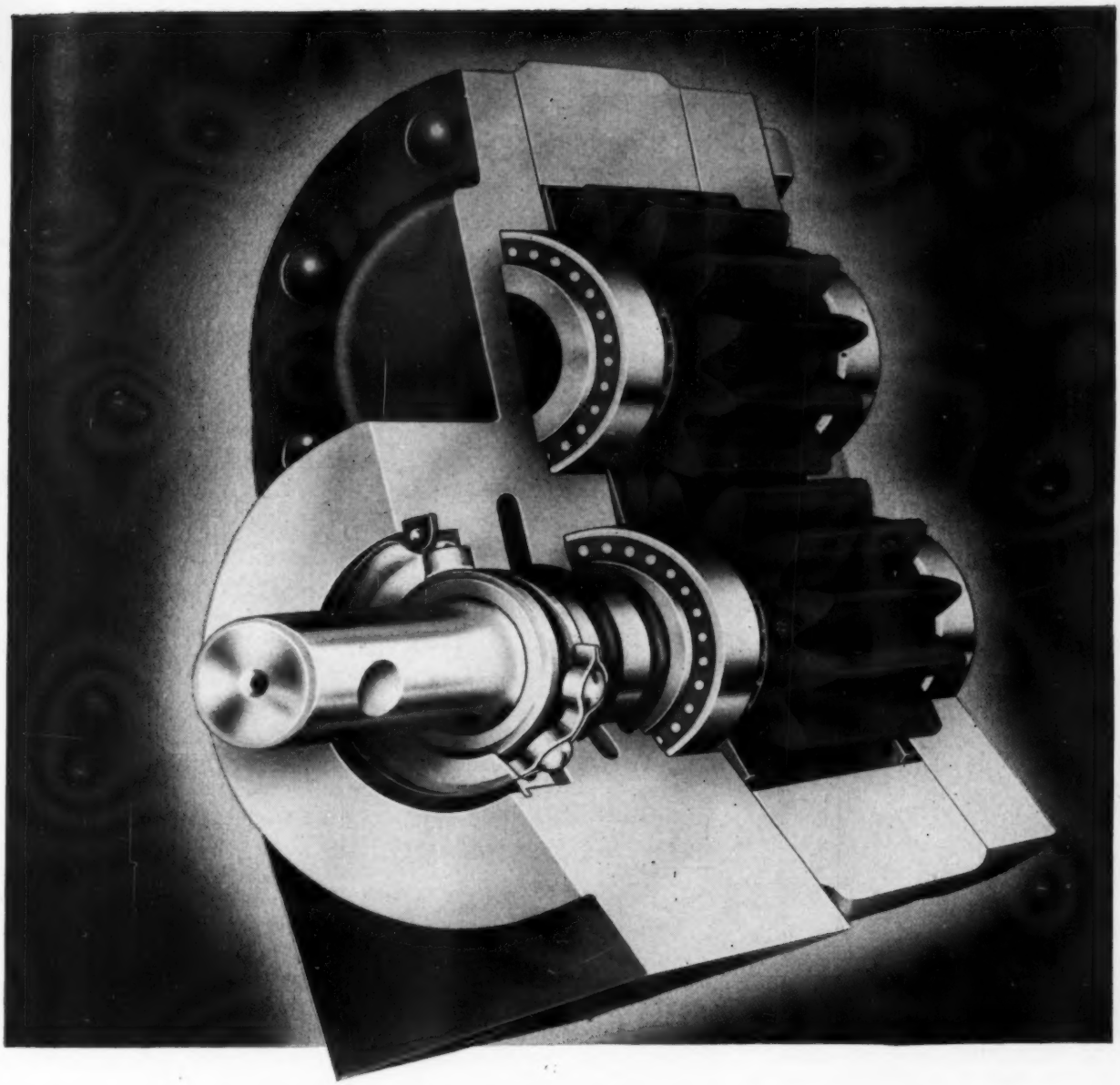
Accumulators are kept charged to 1,250 psi, and the 80 gallons of oil in them enables all four gate cylinders to make two strokes each, yet leave a pressure of 675 psi in the system.

With battery operated solenoids and constantly charged accumulators, the system is thus able to protect the pumping station adequately should any power failure occur.

All four gates are tested each month, or oftener. Plant officials state that the gates invariably close or open completely within 35 to 40 seconds . . . less than one-half the maximum desired operating time.

THREE of the four sluice gates are operated by the action of the float. The fourth gate is push button operated. Battery operation and charged accumulators protect the pumping station in case of power failure.





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A discussion of hose material, couplings, manufacturing and test procedures and service conditions for . . .

FLEXIBLE HOSE ASSEMBLIES for Pneumatic Applications

By P. E. Chorley

HIGH PRESSURE synthetic rubber hose with steel swivel nut termination. Male adaptor with 60 degree cone seating mates with spherical radius on hose insert nipple.

IN very few cases have special hose been developed primarily for conveying air only. These assemblies are usually chosen from types developed as fluid carrying lines.

The typical assembly, as distinct from the ordinary type of shop hose, consists of a synthetic rubber, cotton or wire braid reinforced hose, together with end couplings attached either at the factory by a hydraulic swaging process, or in the field with the simple hand tools. Single or multi-layer cotton or fabric braid reinforced hose construction is usually selected for internal pressures of up to 250 psi; whereas one or two wire braid reinforced types are chosen for medium and high pressures up to 4000 psi.

Hose

Synthetic rubber is selected for the hose because in the majority of air lines there is a degree of oil contamination internally, whether deliberate or unintentional, and in addition a degree of external resistance to such fluids is desirable. For pure air services natural rubber can be used but in certain cases special compounds are specified to prevent any odor from being imparted to the air if it is to be breathed.

Chief mechanical problem as far as the hose itself is concerned is to avoid any porosity of the inner tube, however minute.

HIGH SPEED air turbine hand grinder connected to 100 psi shop air supply by ⅝ inch bore low pressure cotton braided hose.

Couplings

General end coupling design practice for high pressure air lines favors factory attached and permanently swaged types. The success or failure of a complete assembly finally comes down to the pressure sealing and mechanical grip of end coupling upon hose—a tight grip means no leak, a relaxed or insufficient grip invites trouble. Close factory control and extremely high compression pressure on the hose trapped within the coupling by means of hydraulic swaging presses insures the maximum of grip. For a small bore wire braid reinforced hose, a force of up to 10 tons may be required to reduce the diameter of the coupling outer sleeve or ferrule firmly onto the mass of rubber and wire trapped beneath.

To find any subsequent weaknesses, an air pressure test is essential, and for high pressure lines the normal one and a half times working pressure test means that air at pressures in excess of 4,500

P. E. CHORLEY, General Sales Manager, Avica, Equipment Ltd. London, England.

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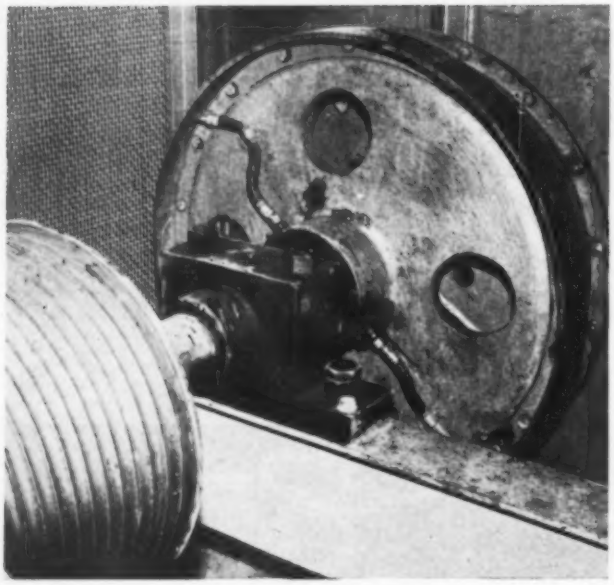

MEDIUM PRESSURE pneumatic lines with factory assembled end couplings on wire braid reinforced hose are used on this coal transporter clutch.

psi must be available, a facility rarely found in plants or maintenance shops. Additionally, testing by air at such high pressures necessitates very adequate protection for personnel in the event of a failure. Fatigue of components tested by air is usually of explosive force as opposed to the more localized nature when fluids are used.

For lower pressures, reusable or quick attachable couplings are quite satisfactory and are coming into more general use.

For both high and low pressures, the favorite end coupling termination is the conventional female swivel nut with coned or radiused insert which mates with a male threaded adaptor. Few users demand any deviation from this principle such as special seatings and seals. A 100 percent pressure tight joint is insured each time the coupling is disconnected and reconnected, without the need for gaskets and jointing compounds. For similar reasons, taper pipe threads are "out".

Manufacture and Testing

All manufacturing processes are similar to those employed for fluid carrying lines, whereas test procedures vary somewhat. In most cases, air pressure testing is carried out under water to show up any leaks, no matter how minor, and to locate their exact source. This factor is important for in the open atmosphere an air leak is difficult to detect and may well be due to some part of the test set-up, connecting adaptors, etc. A leakage of air or gas not exceeding 50 cubic inches per minute will not effect the serviceability of an assembly. In many cases, a small initial leak through the hose inner tube may seal itself during the 5 minute duration of the test period. The test pressure is generally one and a half times the working pressure for each respective diameter and construction of hose.

General practice is to pressure test individually by air, assemblies for use at high pressures—500 psi and over— by means of air supplied either from a high pressure compressor, or shop type compressor with booster. For low pressure lines a 10 percent production check is considered satisfactory, such tests being run directly from shop air lines using quick-disconnect couplings for speedy connections.

Service Conditions

As with all hose assembly installations, it is vitally important that full operating details of the conditions in an air line circuit be made available to the manufacturer. As an example, most current types of hose manufactured from synthetic rubbers are listed as being suitable for use at temperatures up to 140 C. This value, however, usually applies to a fluid passing through the hose, such fluids usually causing some increase in volume, or swelling, of the rubber. This tendency effectively compensates for any slight hose deterioration such as porosity, or for any relaxation of grip of end couplings on hose due to cold flow of the rubber, as a result of age hardening and slow oxidation.

In the case of compressed air, however, this help does not exist and hot compressed air is one of the most trying conditions for a hose assembly. Oil contamination of the air does, in fact, assist. Occasionally, very slow leaks will occur and will show up as an unpleasant blistering of the hose outer cover—these air blisters may be punctured carefully to deflate them, then the cover will usually return to its normal diameter. A rapid leak results in a ruptured and torn inner tube and outer cover.

Pressure Losses

Loss of pressure in air lines due to leakage caused by rough handling or long usage, or distorted or scored coupling mating parts results in a slow-down at the operating end of the circuit and a loss of economy. Such a condition is not always as readily apparent as a fluid leak and may tend to be overlooked. Such losses can be considerable in long shop lines or in involved circuits, and it is for this reason that high pressure wire-braid reinforced hose has been selected for many low and medium pressure services where damage risk is high. It has been proved time and time again that the "fit and forget" formula is a result of specifying flexible lines with a performance well in excess of operating needs, outweighs the initial cost disadvantage as a result of increased reliability. It has been estimated, for example, that on pneumatic tool installations, a 20 psi increase in air pressure at the tool can result in an air increase in production of over 25 percent. Line and joint leakages are therefore a penalty to be avoided, as also is excessive pressure drop between compressor and point of useage. In a well designed system this pressure drop due to pipe bends, internal friction, etc. should not exceed 10 percent.

Regular inspection should be maintained to elim-

Continued on page 134

HANSEN

QUICK CONNECTIVE SHUT-OFF COUPLINGS

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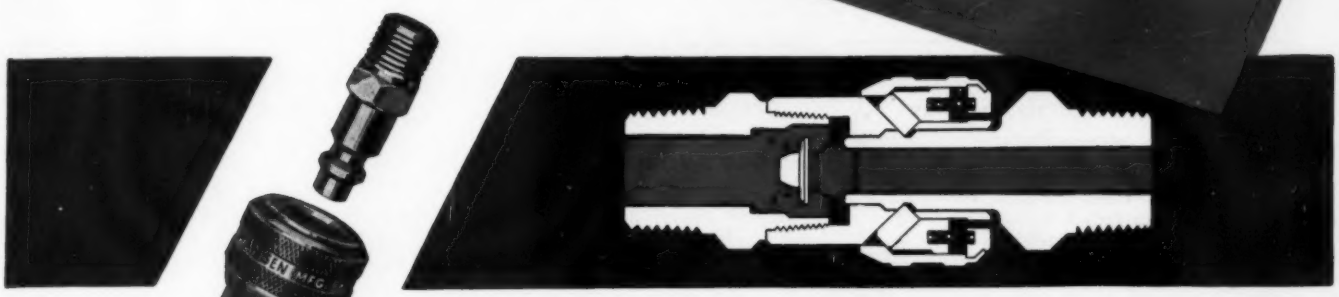

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Cross-section at upper right shows flow through coupling when connected.

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Hydraulic Test Setup Automatically Maintains Given Load

A method for automatically controlling load applications on airplane structures, developed and in use at Northrop Aircraft, Inc. Loads on each point of application are applied by movement of a hydraulic cylinder; the correct load being applied through a deflecting dynamometer which actuates a special load maintainer valve to hold the system "on load" for present deflection. The maintainers have been used for numerous test programs with very good results.

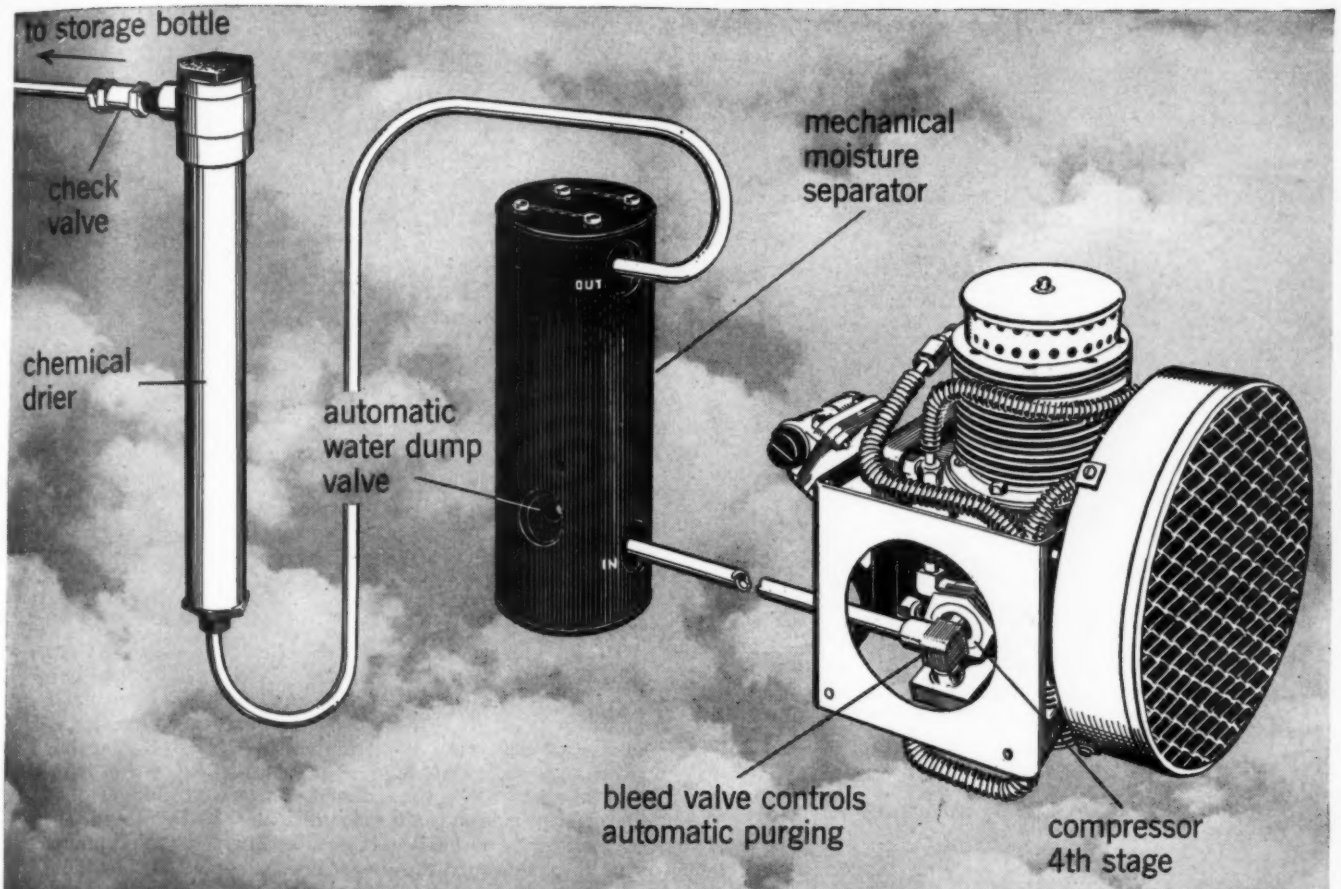
By Dean J. Madsen

THE laboratory testing of aircraft structures has long been an accepted procedure through which airplane designs pass. The structure being tested is subjected to a number of aerodynamic, inertia and other forces acting upon it for the particular condition being considered. The number of these forces being applied could be quite large. Also, since aircraft structures are relatively flexible, a load applied at one point affects a neighboring load, and the neighboring load-applying device or mechanism must be able to correct for this influencing effect. With all of these factors considered, the problem of load application is complex and serious indeed. This article concerns the method of automatically controlling load application as developed at Northrop Aircraft, Inc.

DEAN J. MADSEN is Manager, Engineering Laboratory Test, Northrop Aircraft, Inc., Hawthorne, Calif.

One of the most widely accepted methods of applying loads is by utilizing a load mechanism connected to a hydraulic cylinder exerting a tension load. The correct load is maintained by controlling the oil supplied to the cylinder through the use of hydraulic valves. The control valves are manipulated by hand or by some automatic device. If the number of loads to be applied is very large, manual control becomes impractical because of the number of personnel involved, the time required to arrive "on load" and the danger of locally overloading the specimen.

Recently we were face-to-face with the problem of applying 80 simultaneous loads on a complete airplane structure. The loads varied from approximately 3000 to 75,000 pounds. All of the influencing factors mentioned above were on hand to make the problem serious. Experiments had been made on a load maintaining system which showed good promise; the sys-



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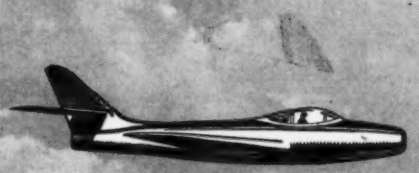

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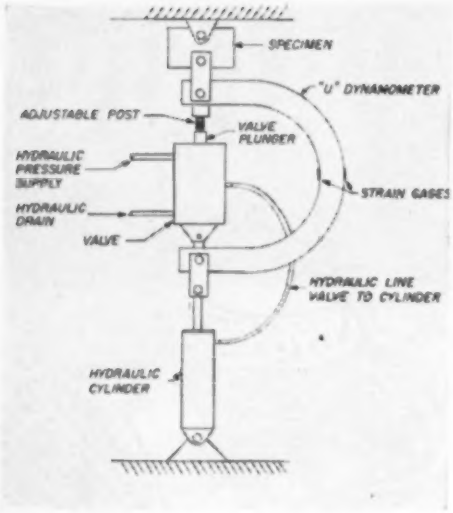


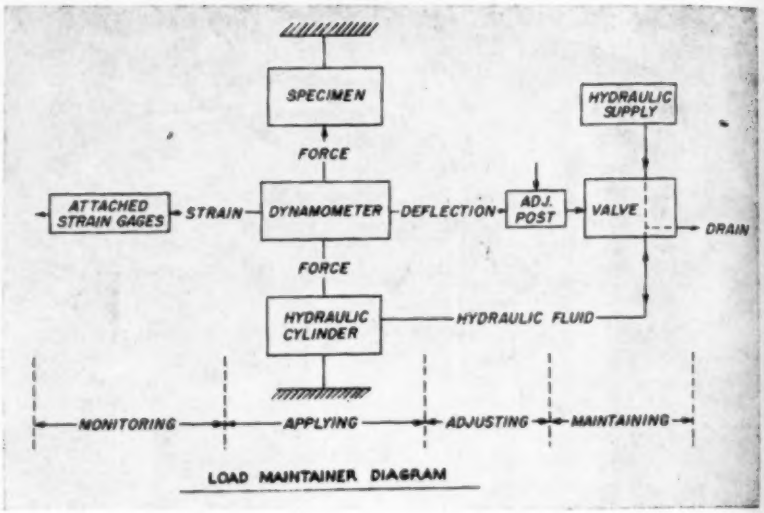
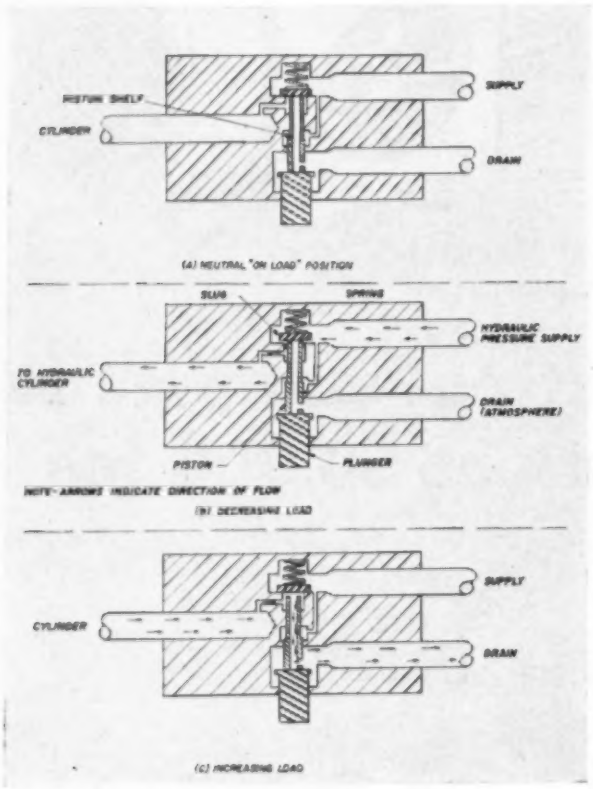


FIG. 1. The functional relationships of the several components of a load maintaining system.

FIG. 2. Schematic arrangement.

FIG. 3. Operation of the load maintainer valve. At (a) the valve is at neutral position when the flow has balanced the "on load" requirement of the dynamometer deflection; at (b) the load has decreased, the dynamometer deflection is less and the valve plunger has risen, opening a passage to pressure flow to the cylinder to restore the preset load. The valve plunger then returns to neutral; at (c) the load has increased, the dynamometer deflection is greater and the valve plunger has lowered, opening a passage for flow from cylinder to drain. The valve bleeds the cylinder until the preset load is restored, at which point the plunger has returned to neutral.



tem described below is the development of this experimental system into one of proven value.

Figure 1 diagrams the functional relationships of the several components of the system. Figure 2 is a schematic arrangement of the physical equipment used. The general operation is as follows:

1. Load is applied by a hydraulic cylinder acting through a deflecting dynamometer.
2. The deflection of the dynamometer actuates a valve, the valve controls the hydraulic flow to the cylinder.
3. The level of the load is changed, e.g., from 20 percent to 40 percent by adjusting the adjusting post.
4. The actual applied load is indicated by the strain gage system.

The load maintaining function is accomplished by the interaction of the dynamometer and the valve. For example, assume that the system is set to maintain a load of 20 percent and that the system is "on load". This means that the dynamometer is deflected to a 20 percent load condition and the valve is at neutral. Now, if for some reason, the load falls off the dynamometer deflection becomes less, the valve plunger is moved and the hydraulic fluid flows to the cylinder until the 20 percent load is restored and the valve returns to neutral. Or, if the load increases, the valve bleeds fluid from the cylinder until the 20 percent load is restored. The operation of the valve is illustrated in Figure 3. In following through the diagrams it should be kept in mind that the piston follows the plunger at all times.

The system must, of course, maintain a load of any given value. This means that the relation between the dynamometer deflection and valve neutral must be changeable. In other words, the valve must be at neutral when the system is "on load" at 20 percent, 50 percent, 100 percent or any other "on load" percentage. This is accomplished by extending or retracting the adjustable post.

For example, let us assume that the system is at zero percent load, and is to be taken to 20 percent load. The adjustable post is extended the known amount by which the dynamometer will be deflected by the 20 percent load. The extension of the post moves the valve plunger away from the neutral position; hydraulic fluid flows to the hydraulic cylinder until a 20 percent load is reached, at which time the valve is again at neutral and the system is "on load" at 20 percent. To make the system capable of remote control operation, the post is adjusted by means of a reversible electric motor and gear train, as shown in Figure 4.

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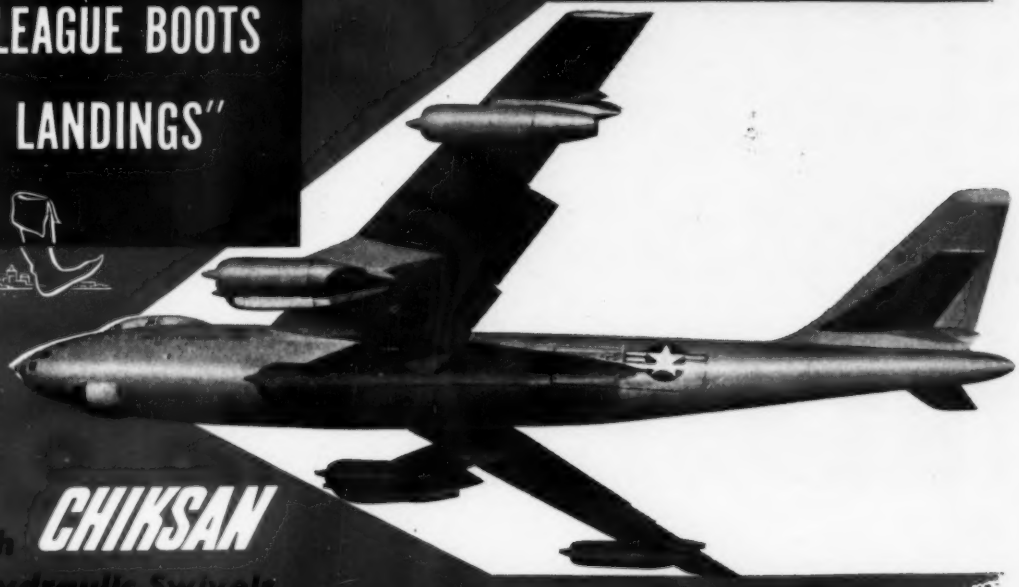

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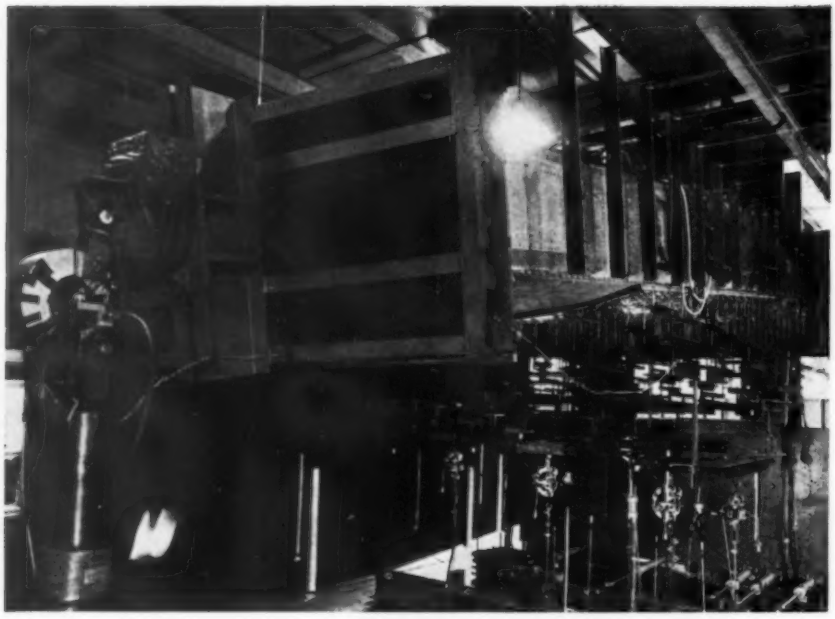


FIG. 4. A wing static test at Northrup with six load maintainer setups. The view shows outboard end loading fixture and whiffletree loading setup. Note the variation in sizes of dynamometers.

The load monitoring phase consists of strain gages attached to the dynamometer, the strain signals being delivered to the remote control station and indicated on a meter or on an automatic record, or both, as required.

Some Applications

Figure 4 shows six load maintainer setups being used on a wing static test. Note that the size of dynamometer varies quite considerably. Also, note that the load maintainer is placed as close as possible to the point of load application to the specimen.

Figure 5 shows the remote control station for a fuselage test utilizing six load maintainers. The strain gage signals of the load-monitoring system are being indicated and recorded on the Brown recorder. The hydraulic supply bench is in the background. The switches for operating the electric motors of the adjustable post can be seen in the lower corners of the photograph. Note that each panel has a master switch. The master switches are used to start all maintainers simultaneously when a change of load level is desired. Since dynamometers of different stiffnesses may be used, some posts must be extended more than others and the motors must be operated varying lengths of time. Individual motors are, therefore, turned off at the appropriate times, depending on dynamometer stiffness. Individual switches are also used to make small adjustments in load level in cases where the apparent "on load" point is slightly high or low.

Time / *Maintainer*	2:22	2:24	2:26	2:28	2:35	2:42
1	24.8	50.5	50.0	48.7	50.0	50.2
2	25.9	51.8	51.1*	48.8*	51.0	51.2
3	24.3	51.5	51.1	51.2	52.0	51.2
4	24.3	49.3	48.4*	50.3	50.0	50.0
5	25.5	50.2	50.1	50.3	50.2	50.0
6	25.2	51.2	51.0	50.5	50.2	50.4

(Shot bags were applied to specimen between 2:22 and 2:35)
*load level adjustments

TABLE 1 Table of Load Values in Percent

Table 1 is a portion of data taken during an empen-

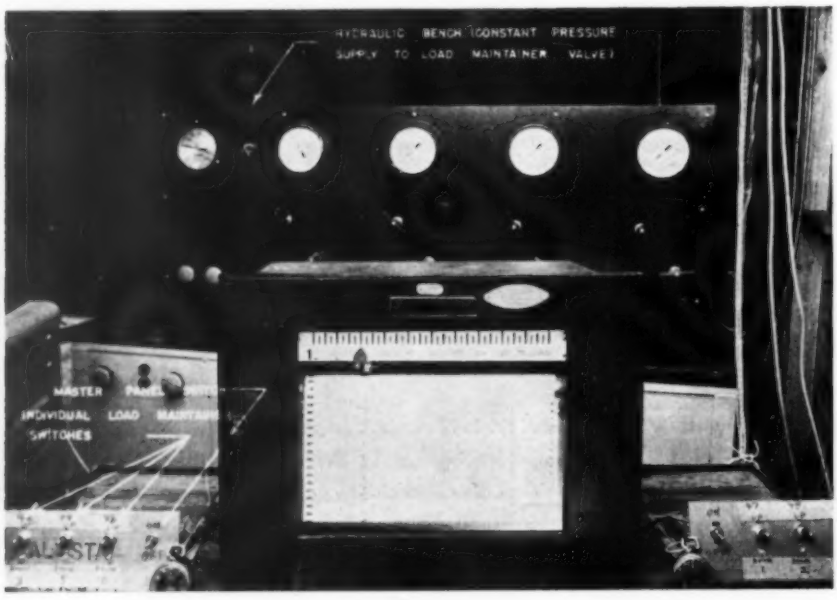
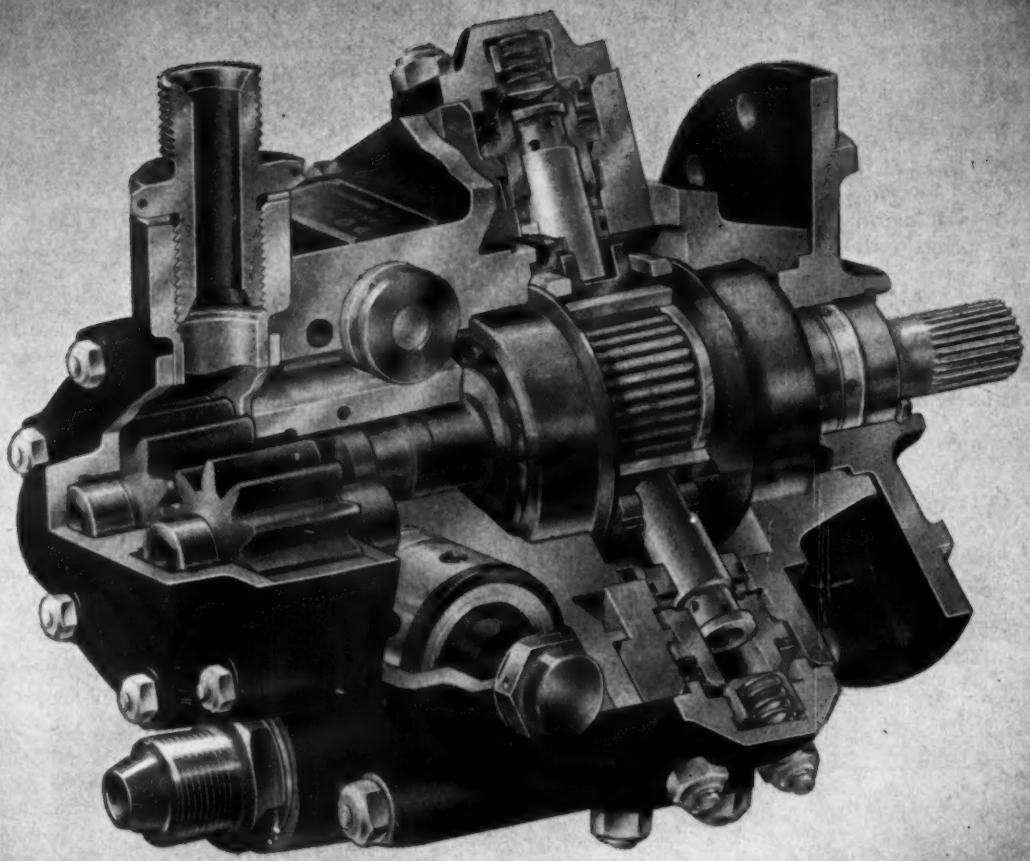


FIG. 5. The remote control station for a fuselage test using six load maintainers. The strain gage signals of the load monitoring system are indicated and recorded on the recorder. Switches for operating motor drives of the adjustable post are shown at lower left and right.

DOWTY



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nage test which utilized six load maintainers. The maintained loads ranged from 300 to 18,000 pounds and the dead weight application was 12,260 pounds

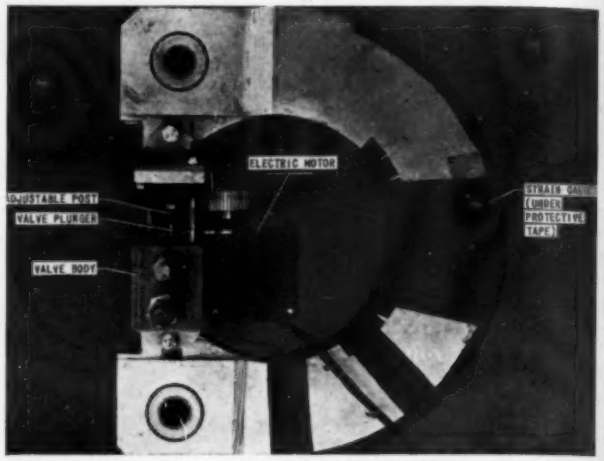

FIG. 6. The load maintainer system is changed to a new load level by movement of the adjustable post. Remote control operation is provided by means of a reversible electric motor and gear train. Strain gages attached to the dynamometer deliver signals to the remote control station (see Figure 5).

for the 100 percent values. This set of data was chosen to show how the maintainers operated during the thirteen minutes of shot bag loading. The maintainers were controlling elevator and aft fuselage loads and the shot bags were placed on the horizontal stabilizer; thus the two kinds of loads were directly influenced by each other.

In studying the table it can be seen that:

1. Maintainer number 2 was adjusted first downward, then upward, and apparently over-adjusted in each case.
2. Maintainer number 3 was maintaining at a level of between 51 and 52 percent, and should have been adjusted downward by 1-½ percent.
3. On low percent loads, no adjustment is made if the load error remains within plus or minus 2 percent.

As noted previously, the dynamometers vary in size according to the range of loads being handled. The valve design is such, however, that it is used for all sizes of dynamometers.

The gear train is designed so that it takes approximately one minute to add 20 percent of load. Thus, within one minute the specimen will be "on load" at the new level. This is extremely important because the specimen should not be penalized by being required to support the high load conditions for unnecessarily long periods of time.

Although the 80-loading-point test did not materialize, the Northrop Engineering Laboratory has used the maintainers on numerous test programs with real success. These devices have been most dependable and serviceable; they have never given trouble or doubtful results. They are rugged and require only reasonable care and maintenance.

Preparations are now being made for a test program which will utilize 14 maintainers; it is planned to incorporate an automatic timing device to operate the electric motors during load-level changes. This new test program will undoubtedly further prove the usefulness of these load maintainers.

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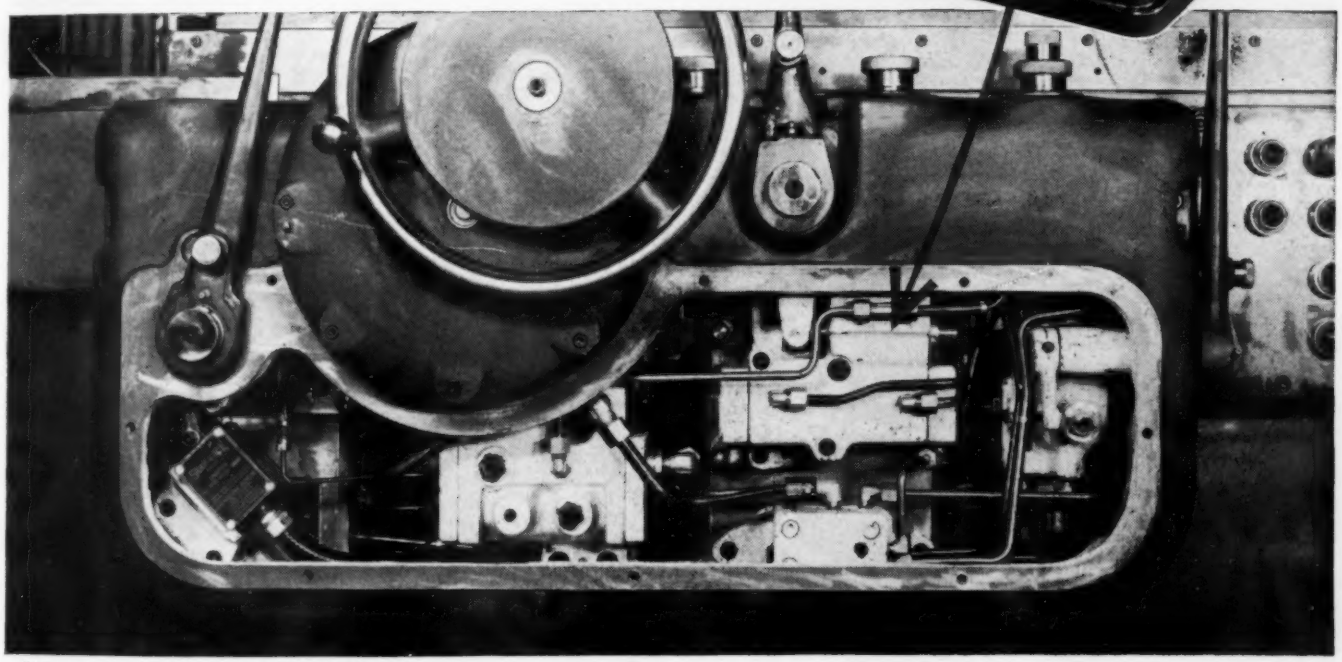

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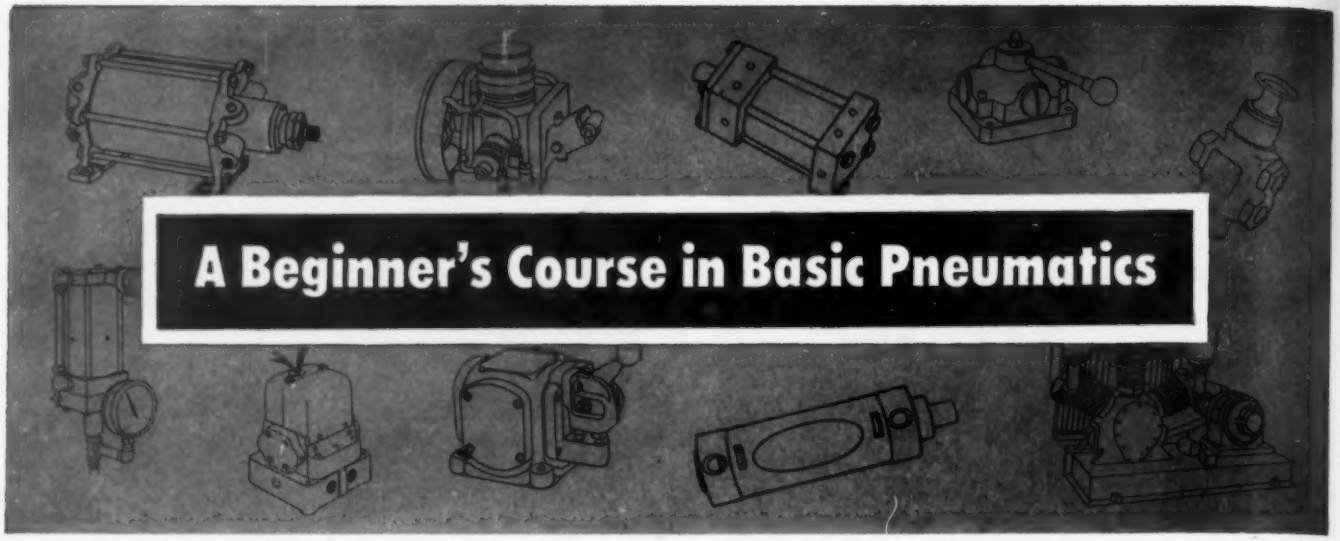

A Beginner's Course in Basic Pneumatics

Section II

The Distribution System

Part II

How To Figure Friction Losses

THE flow of air in pipes has been studied exhaustively and various formulas have been worked out from which tables, nomographic and other type charts have been constructed for convenient use. Except for one formula, it is beyond our scope to survey such formulas.*

This exception, the Harris formula, will be used as an illustration of the relation of such formulas to the makeup of tables. It has been selected because one of the most widely used set of tables for determining the friction of air in pipes (Figures 2 and 3) is based on this formula.

The Harris formula is

$$f = \frac{cL}{r} \times \frac{Q^2}{d^5}$$

in which

f = pressure drop in psi
L = length of pipe in feet
Q = cu ft of air/sec (free air)
r = ratio of compression (from free air at entrance of pipe)
d = actual internal diameter of pipe in inches
c = experimental coefficient

The coefficient for ordinary pipe $= \frac{.1025}{d^{.31}}$. Substituting this value for c in the formula, we have

$$f = \frac{.1025L}{r} \times \frac{Q^2}{d^{5.31}}$$

Solving by an example, let us take a system which has 300 feet of 2 inch main line piping and handles 500 cfm of free air. Initial pressure is atmospheric, final pressure is 100 psi, gauge. We will solve for the pressure loss in psi due to friction.

$$r = \frac{\text{final abs pressure}}{\text{initial abs pressure}} = \frac{114.7}{14.7}$$

$= 7.8$ ratio of compression

---

* *For a detailed analysis of the more commonly used formulas and tables for fluids and gases see Sabin Crocker's "Piping Handbook". A useful bibliography of pneumatic data is included (section C) in APPLIED HYDRAULICS Data List, copies of which are available on request.*

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HYDRAULIC AND PNEUMATIC EQUIPMENT...CYLINDERS...VALVES...RIVETERS

Nominal Pipe Size inches	Schedule number or weight	Outside Diameter D	Inside Diameter d	Wall Thickness t	$d^{5-1/3}$ or $d^{5.333}$
⅜	40	.675	.493	.091	.0230
½	40	.840	.622	.109	.0631
¾	40	1.050	.824	.113	.3561
1	40	1.315	1.049	.133	1.291
1¼	40	1.660	1.380	.140	5.572
1½	40	1.900	1.610	.145	12.68
2	40	2.375	2.067	.154	48.08
2½	40	2.875	2.469	.203	124.0
3	40	3.500	3.068	.216	395.0
3½	40	4.000	3.548	.226	857.5
4	40	4.500	4.026	.237	1683
5	40	5.563	5.047	.258	5627
6	40	6.625	6.065	.280	14970
6	Special	6.625	6.125	.250	15773
6	Special	6.625	6.250	.188	17567

FIG. 1. Inside-diameter functions of steel pipe for use in gas and air flow formulas.

$d^{5.31} = 48.06$ This value for 2 inch pipe is taken from Inside-Diameter Functions of Steel Pipe for Use in Gas and Air Flow Formulas (Figure 1).

We now substitute in the formula

$$f = \frac{.1025L}{r} \times \frac{Q^2}{d^{5.31}}$$

$$= \frac{.1025 \times 300}{7.8} \times \frac{8.3 \times 8.3}{48.06}$$

$= 5.5948 = 5.6$ psi pressure drop

This result can be checked by using Figure 3. With the same factors, we enter the table at the 500 cfm line and column 2 inches, we find N factor of 150. This factor divided by the ratio of compression (r) gives the loss of psi per 1000 feet

$$\frac{150}{7.8} = 19.2 \text{ psi}$$

Since our system has 300 feet of 2 inch piping, the loss in psi is $\frac{300}{1000} \times 19.2 = 5.76$ psi pressure drop due to friction.

This is very close to the result computed by formula and can be used with confidence. It must be remembered that this pressure drop is for the two inch line only and friction losses in other size pipes in the system as well as losses due to resistance through bends or turns, fittings and valves must be added to obtain the total pressure loss through the system.

Similarly, Figure 3 can be used to determine any unknown. For example, if a maximum pressure drop of 20 psi per 1000 feet is desired with a flow of 500 cfm and with the same ratio of compression, the size of pipe can be determined.

$N = 20$ (approx) $\times 7.8 = 156$

Enter table, Figure 3 for nearest N for 400 cfm. This is 150, the N for a 2 inch pipe. Therefore, select the 2 inch pipe.

Or the initial absolute pressure may be required. Assume we have the same 500 cfm flow through a 2 inch pipe and the pressure drop is approximately 20

FIG. 2. Factors for flow of compressed air through standard weight steel pipe (5 to 300 cfm). Data based on the Harris formulas.

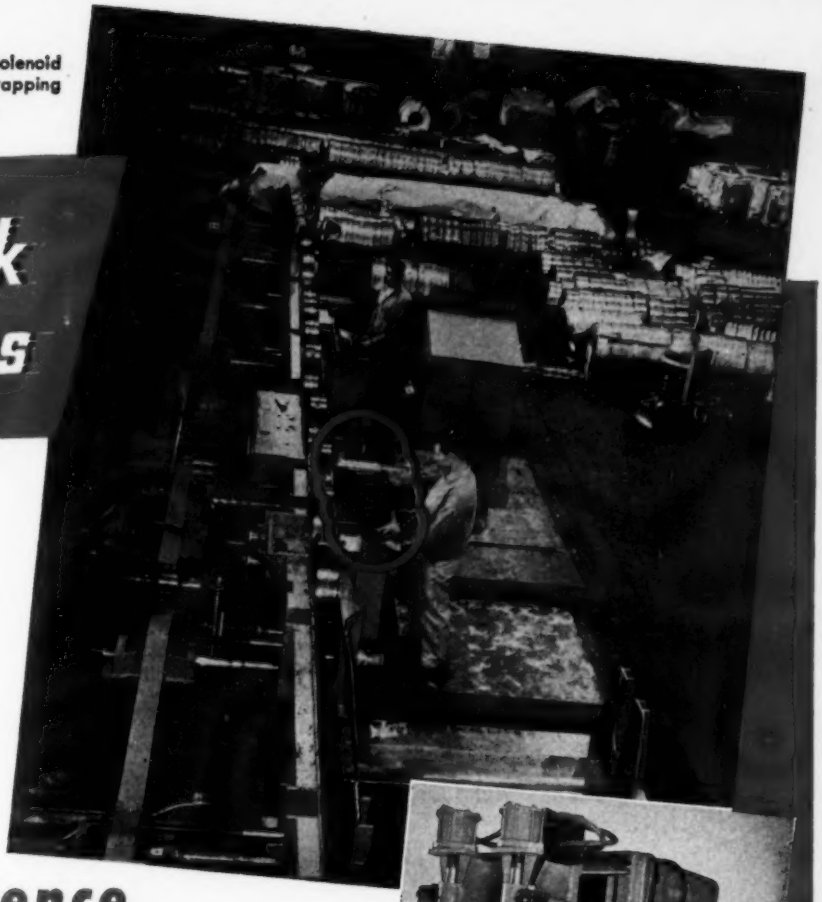
FIG. 3. Factors for flow of compressed air through standard weight steel pipe (320 to 3000 cfm free air). Data based on the Harris formulas.

Cu. Ft Free Air per Min.	Nominal Diameter in Inches								
	¾	¾	1	1¼	1½	1¾	2	2½	3
5	8.9	2.0	.5	...	...	...	...	...	...
10	35.4	8.0	2.1	.5	...	...	...	...	...
15	79.7	17.9	4.9	1.1	...	...	...	...	...
20	141.	31.8	8.7	2.0	.9	...	...	...	...
25	221.	49.7	13.6	3.2	1.4	.7	...	...	...
30	318.	71.	19.6	4.5	2.0	1.1	...	...	...
35	434.	97.5	26.6	6.2	2.7	1.4	...	...	...
40	567.	127.	34.8	8.1	3.6	1.9	...	...	...
45	718.	161.	44.0	10.2	4.5	2.4	1.2	...	...
50	885.	199.	54.4	12.6	5.6	2.9	1.5	...	...
60	.....	286.	78.3	18.2	8.0	4.2	2.2	...	...
70	.....	390.	106.6	24.7	10.9	5.7	2.9	1.1	...
80	.....	510.	139.2	32.3	14.3	7.5	3.8	1.5	...
90	.....	645.	176.2	40.9	18.1	9.5	4.8	1.9	...
100	.....	796.	217.4	50.5	22.3	11.7	6.0	2.3	...
110	.....	963.	.....	61.1	27.0	14.1	7.2	2.8	...
120	.....	.....	318.	72.7	32.2	16.8	8.6	3.3	...
130	.....	.....	369.	85.3	37.8	19.7	10.1	3.9	1.3
140	.....	.....	426.	98.9	43.8	22.9	11.7	4.6	1.4
150	.....	.....	490.	113.6	50.3	26.3	13.4	5.2	1.6
160	.....	.....	570.	129.3	57.2	29.9	15.3	5.9	1.9
170	.....	.....	628.	145.8	64.6	33.7	17.2	6.7	2.1
180	.....	.....	705.	163.3	72.6	37.9	19.4	7.5	2.4
190	.....	.....	785.	177.	80.7	42.2	21.5	8.4	2.6
200	.....	.....	870.	202.	89.4	46.7	23.9	9.3	2.9
220	.....	.....	.....	244.	108.2	56.5	28.9	11.3	3.5
240	.....	.....	.....	291.	128.7	67.3	34.4	13.4	4.2
260	.....	.....	.....	341.	151.	79.0	40.3	15.7	4.9
280	.....	.....	.....	395.	173.	91.6	46.8	18.2	5.7
300	.....	.....	.....	454.	201.	105.1	53.7	20.9	6.6

Free air, cfm	Nominal diameter in inches									
	2	2½	3	3½	4	4½	5	6	8	10
320	61.1	23.8	7.5	3.5						
340	69.0	26.8	8.4	3.9	2.0					
360	77.3	30.1	9.5	4.4	2.2					
380	86.1	33.5	10.5	4.9	2.5					
400	94.7	37.1	11.7	5.4	2.7					
420	105.2	40.9	12.9	6.0	3.1					
440	115.5	44.9	14.1	6.6	3.4					
460	125.6	48.8	15.4	7.1	3.7	2.0				
480	137.6	53.4	16.8	7.8	4.0	2.2				
500	150.0	58.0	18.3	8.5	4.3	2.4				
525	165.0	64.2	20.2	9.4	4.8	2.6				
550	181.5	70.2	22.1	10.2	5.2	2.9				
575	197	76.7	24.2	11.2	5.7	3.1				
600	215	83.5	26.3	12.2	6.2	3.4				
625	233	92.7	28.5	13.2	6.8	3.7				
650	253	98.0	30.9	14.3	7.3	4.0	2.2			
675	272	105.7	33.3	15.4	7.9	4.3	2.4			
700	294	113.7	35.8	16.6	8.5	4.6	2.6			
750	337	130.5	41.1	19.0	9.7	5.3	2.9			
800	382	148.4	46.7	21.7	11.1	6.1	3.3			
850	433	168	52.8	24.4	12.5	6.8	3.8			
900	468	188	59.1	27.4	14.0	7.7	4.2			
950	541	209.4	65.9	30.5	15.7	8.6	4.7			
1,000	600	232.0	73.0	33.8	17.3	9.5	5.2	1.9		
1,050	658	256	80.5	37.8	19.1	10.4	5.8	2.1		
1,100	723	280.6	88.4	40.9	21.0	11.5	6.3	2.4		
1,150	790	306.8	96.6	44.7	22.9	12.5	6.9	2.6		
1,200	850	344.0	105.2	48.8	25.0	13.7	7.5	3.3		
1,300	.....	392.0	123.4	57.2	29.3	16.0	8.8	8.8		
1,400	.....	.....	.....	66.3	33.9	18.6	10.2	3.8		
1,500	.....	.....	.....	76.1	39.0	21.3	11.8	4.4		
1,600	.....	.....	.....	86.6	44.3	24.2	13.4	5.1		
1,700	.....	.....	.....	97.8	50.1	27.4	15.1	5.7		
1,800	.....	.....	.....	110.0	56.1	30.7	16.9	6.4		
1,900	.....	.....	.....	122	62.7	34.2	18.9	7.1	1.6	
2,000	.....	.....	.....	135	69.3	37.9	20.9	7.8	1.8	
2,100	.....	.....	.....	149	76.4	40.8	23.0	8.7	2.0	
2,200	.....	.....	.....	166	83.6	45.8	25.3	9.5	2.2	
2,300	.....	.....	.....	179	91.6	50.1	27.6	10.4	2.4	
2,400	.....	.....	.....	195	99.8	54.6	30.1	11.3	2.6	
2,500	.....	.....	.....	212	108.3	59.2	32.6	12.3	2.9	
2,600	.....	.....	.....	229	117.2	64.9	35.3	13.3	3.1	
2,700	.....	.....	.....	247	126	69.1	38.1	14.3	3.3	
2,800	.....	.....	.....	265	136	74.3	41.0	15.4	3.6	
2,900	.....	.....	.....	285	146	79.8	43.9	16.5	3.9	
3,000	.....	.....	.....	305	156	85.2	47.0	17.7	4.1	

Quick-As-Wink Double Solenoid Air Valves on Coil Strapping and Oiling Line.

Quick-As-Wink Control Valves



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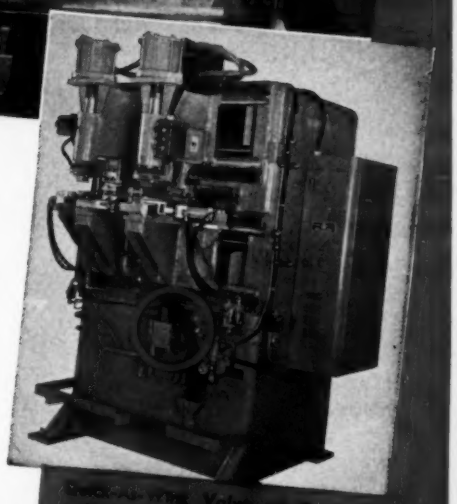

Quick-As-Wink Valves on Double Hydraulic Projection Welder

Quick-As-Wink Valves on Sequence Operation Multiple Welding Machine

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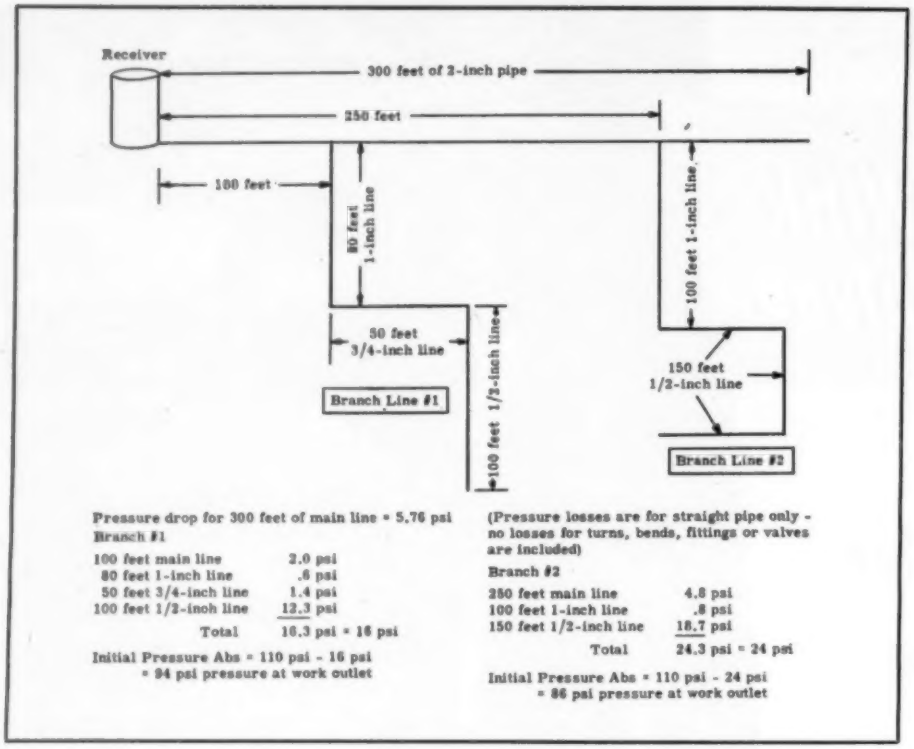

Receiver
300 feet of 2-inch pipe
250 feet
100 feet
80 feet 1-inch line
100 feet 1-inch line
50 feet 3/4-inch line
Branch Line #1
100 feet 1/2-inch line
150 feet 1/2-inch line
Branch Line #2
Pressure drop for 300 feet of main line = 5.76 psi
Branch #1
100 feet main line 2.0 psi
80 feet 1-inch line .6 psi
50 feet 3/4-inch line 1.4 psi
100 feet 1/2-inch line 12.3 psi
Total 16.3 psi = 16 psi
Initial Pressure Abs = 110 psi - 16 psi
= 94 psi pressure at work outlet
(Pressure losses are for straight pipe only - no losses for turns, bends, fittings or valves are included)
Branch #2
250 feet main line 4.8 psi
100 feet 1-inch line .8 psi
150 feet 1/2-inch line 18.7 psi
Total 24.3 psi = 24 psi
Initial Pressure Abs = 110 psi - 24 psi
= 86 psi pressure at work outlet

FIG. 4. Diagram of main line and branches of a compressed air distribution system. (not to scale)

psi per 1000 feet, we proceed by entering the table at line 500 cfm and column 2 inch nominal diameter of pipe. We find the N factor of 150. Since

$$r = \frac{N}{20} = \frac{150}{20} = 7.5$$

$7.5 \times 14.7 = 110.3$ psi abs initial pressure.

Or with the same 2 inch pipe and 20 psi pressure drop per 1000 feet and initial absolute pressure of 110 psi, the flow in cfm of free air may be found.

$$r = \frac{110}{14.7} = 7.48 = 7.5$$

$N = 7.5 \times 20 = 150$

Enter table and at line in column of 2 inch nominal pipe size at which 150 is listed, we have 500 cfm flow.

Pressure Losses in Branch Lines

So far we have considered only a main line. Since there will be pressure losses due to friction throughout the air distribution system, we can get a better appreciation of the importance of friction by determining such losses through both main and branch lines or from the compressor or receiver to the point of use. Let us assume that we have two branch lines off of our 2 inch main line.

At a point 100 feet along the main line the first line branches off. This branch has successively 80 feet of one inch line, 50 feet of ¾ inch line and 100 feet of ½ inch iine. At a point 250 feet from the receiver on the main line we have a second branch. The branch has 100 feet of 1 inch line and 150 feet of ½ inch line. Each branch line is to handle 50 cfm free air. For our purpose we will assume that the initial absolute pressure at the outlet of the main line is 110 psi.

Let us determine the pressure loss in the first branch line. First, we should know the pressure at the first junction (2 inch line with the one inch line).

$$\frac{100}{1000} \times 19.2 \text{ psi} = 2 \text{ psi pressure loss to first junction}$$

$110 - 2 = 108$ psi at outlet to one inch line

Then determine the pressure drop in the 80 feet of one inch line.

$N = 54.4$ (50 cfm and one inch)

$$r = \frac{108}{14.7} = 7.34$$

$$\text{Pressure drop} = \frac{N}{r} = \frac{54.4}{7.34} = 7.41 = 7.4 \text{ psi/1000 ft}$$

$$\frac{80}{1000} \times 7.4 = .591 = .6 \text{ psi for 80 feet}$$

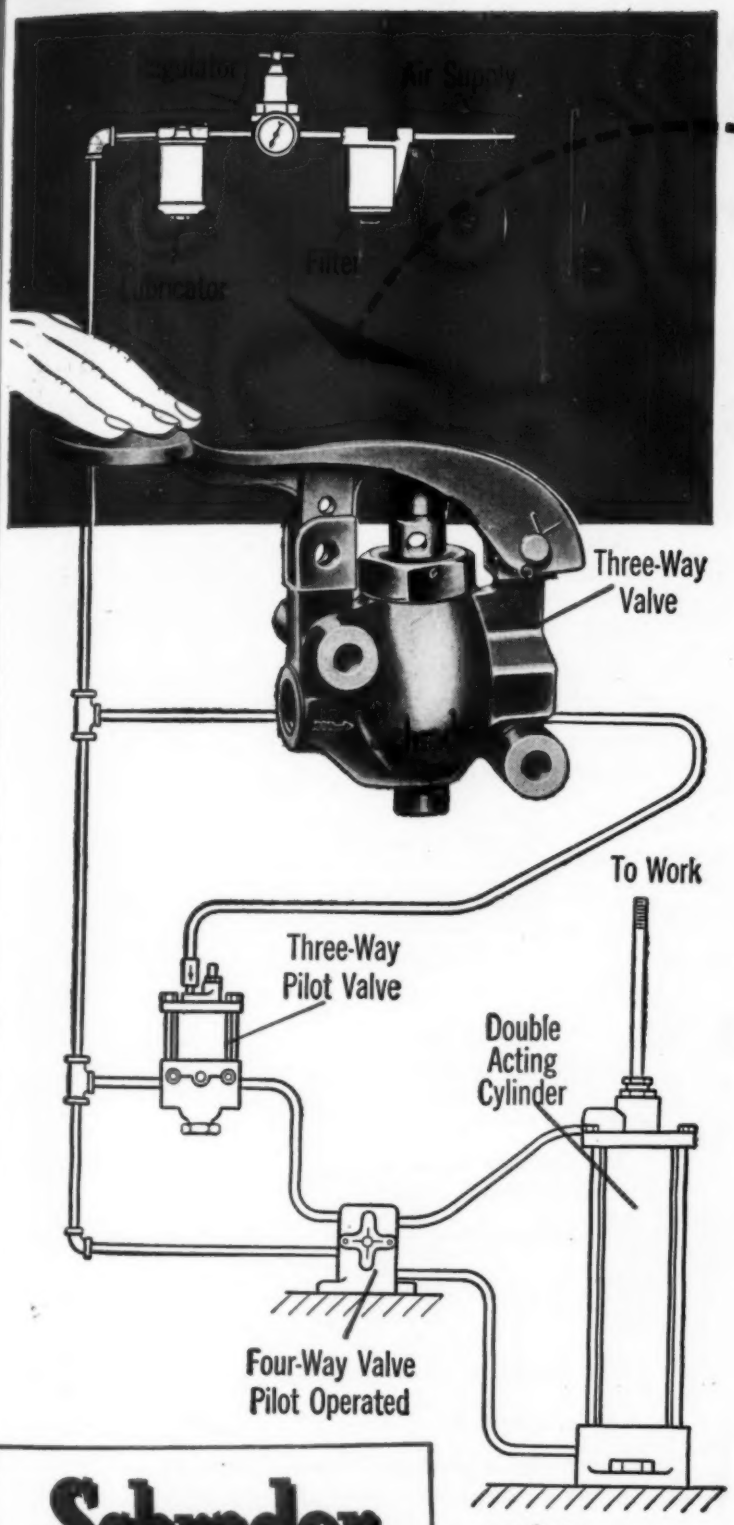
We then repeat this process for the ¾ inch line. The initial pressure at the ¾ inch line would be $108 - .6 = 107.4$ psi

$N = 199$ (50 cfm and ¾ inch)

$$r = \frac{107.4}{14.7} = 7.3$$

$$\text{Pressure drop} = \frac{N}{r} = \frac{199}{7.3} = 27.3 \text{ psi/1000 feet}$$

$$\frac{50}{1000} \times 27.3 = 1.4 \text{ psi for 50 feet}$$



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We then add the pressure loss for the ½ inch line. The initial pressure at the ½ inch line would be
$107.4 - 1.4 = 106$ psi
$N = 885$ (50 cfm and ½ inch)

$$r = \frac{106}{14.7} = 7.2$$

$$\text{Pressure drop} = \frac{N}{r} = \frac{885}{7.2} = 122.9 \text{ psi/1000 feet}$$

$$\frac{100}{1000} \times 122.9 = 12.3 \text{ psi for 100 feet}$$

Adding this pressure loss to that at the inlet of the ½ inch line we have

$106 - 12.3 = 93.7$ or 94 psi as the pressure at the point of work.

After the procedure is understood the pressure losses for each line due to friction can be determined and tabulated as shown in Figure 4. This can be done directly on the circuit diagram.

Branch number 2 can be analyzed in the same manner and the pressure losses due to friction determined.

The pressure loss in the main line to the junction with the one inch line would be

$\frac{250}{1000} \times 19.2$ psi $= 4.8$ psi. Therefore the available pressure at the inlet of the one inch line would be 105.2 psi.

With N of 54.4 and $r = \frac{105.2}{14.7} = 7.2$, the pressure drop would be $\frac{54.4}{7.2} = 7.6$ psi/1000 feet or .76 or .8 psi for 100 feet.

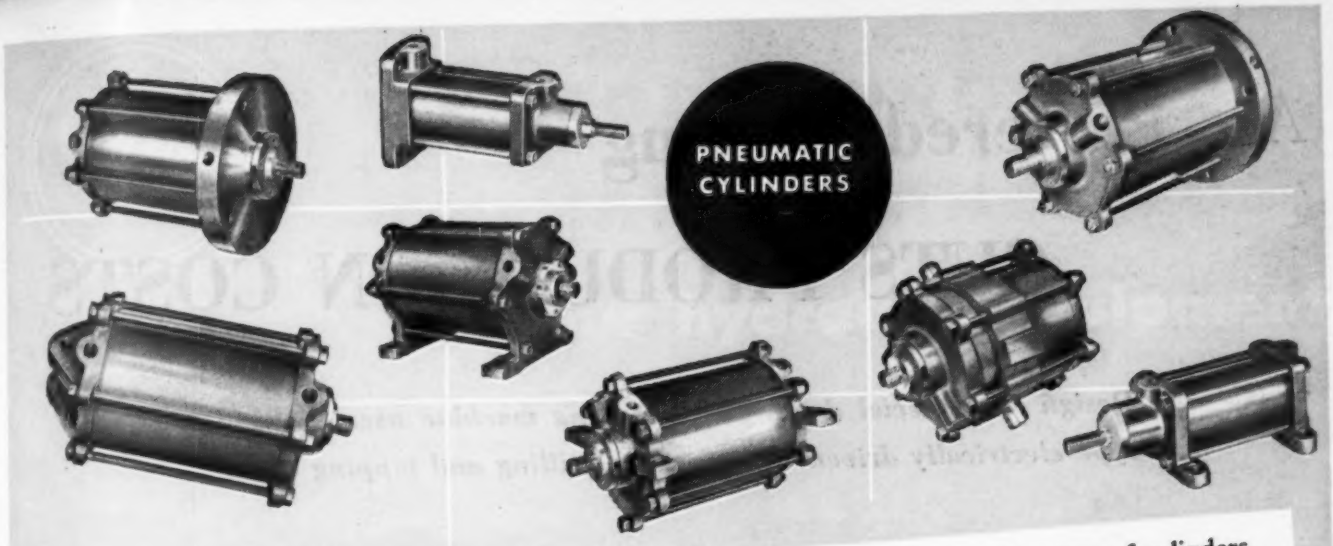
The pressure available at the inlet to the ½ inch line would then be $105.2 - .8 = 104.4$ psi.

The pressure loss in the ½ inch line then would be with N of 885 and $r = \frac{104.4}{14.7} = 7.1$, the pressure drop would be $\frac{885}{7.1} = 124.6$ psi/1000 feet or 18.7 psi for 150 feet.

The available pressure at the end of the ½ inch line would be 104.4 psi − 18.7 psi. = 85.7 psi.

So far we have only determined the loss of pressure in straight lengths of pipe. Losses due to turns or bends, fittings and valves must be added to give total friction losses in air systems and consequently, available pressures at the point of work. At this point it is apparent that friction losses can be considerable and that the selection of sizes of pipe as well as the determination of the shortest length of lines possible are important in the layout of any compressed air system.

The next installment will introduce the friction losses due to turns or bends, fittings and valves and give examples of such losses.



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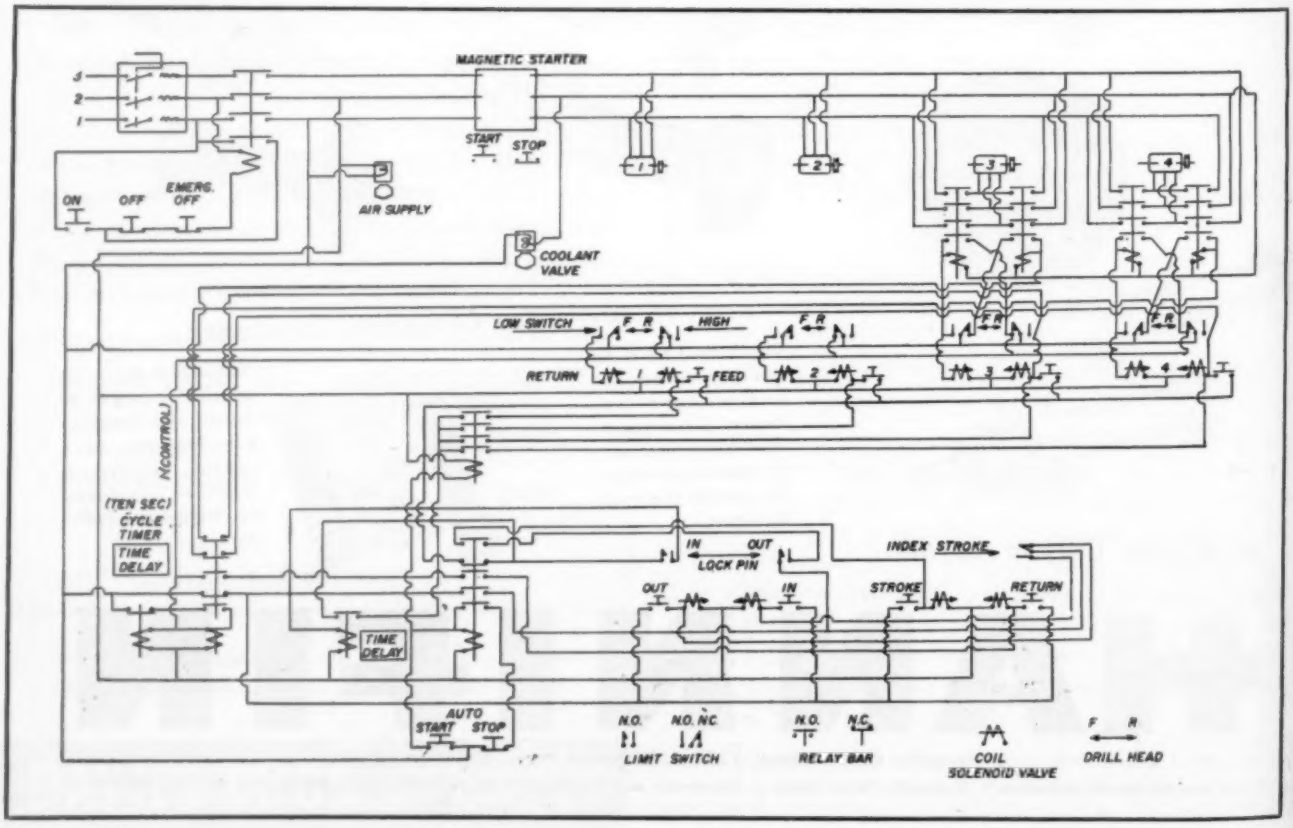
An example, a four spindle drilling and tapping machine, designed and built in Jack & Heintz's own shops is used to machine more than twenty types and sizes of interpoles. The machine table, with special air operated indexing and interchangeable clamping jaws, is designed to operate in conjunction with standard package type electrically driven, air operated drilling and tapping units. Average production runs are such that either partial or complete machine setups of less than two hours time are frequently required. Tool changes average once each two days of operation of two shifts.

The index table has a central hub built around a stationary cam. There are five stations—four work stations, two for drilling and two for tapping, and a load station. A recess in the hub at each station contains a back rest plate, a fixed clamping jaw and a movable clamping jaw. The movable jaw is in an open position at the loading station and in a closed or locked position through the rest of the cycle by

FIG. 1. Electrical diagram for the four spindle drilling and tapping machine.



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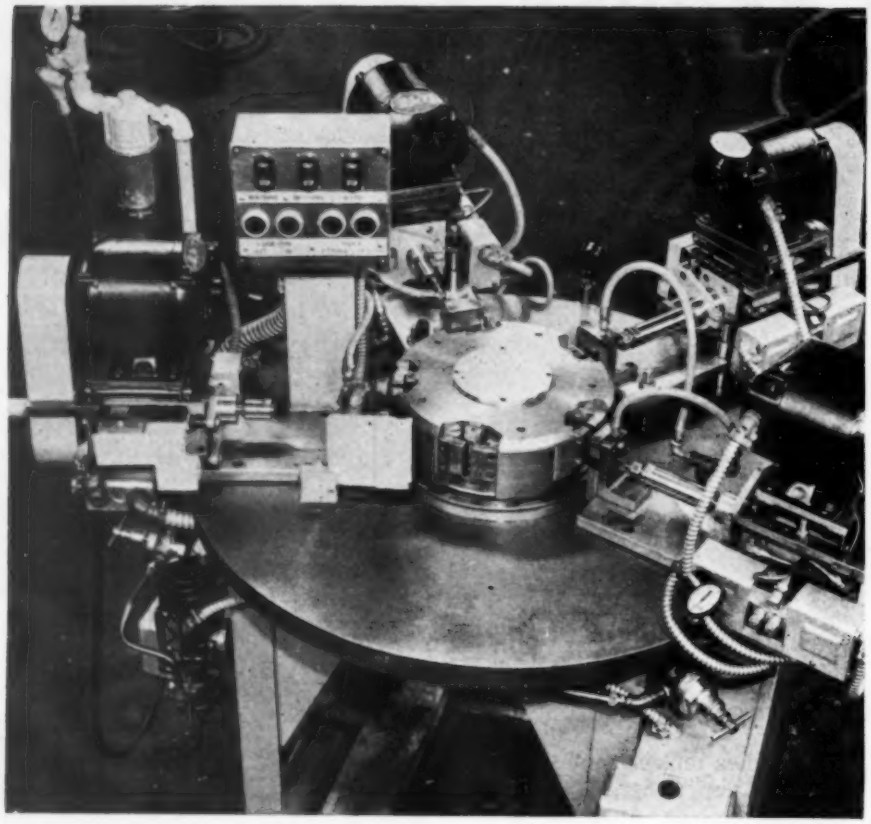


FIG. 2. The air actuated four spindle drilling and tapping machine, one of a group of such machines at Jack & Heintz, has just been set up for a production run. The double solenoid air valves, speed control valves, gauges and air cylinder stroke assemblies of individual package units and the interchangeable clamping jaws and back rests in the work head are shown.

means of a roller which runs against the central stationary cam. Heavy die-type springs exert a force of approximately 400 pounds on the movable jaw so that the work piece is securely locked in the station through the work cycle. Indexing is actuated by an air cylinder through a pawl and ratchet. An air operated lock pin controls position during the work cycle.

The drilling and tapping units are essentially two

Fig. 3. Rear view of the machine showing control components of the drill heads. Solenoid valves, pressure regulators and lubricators, and gauges are shown.

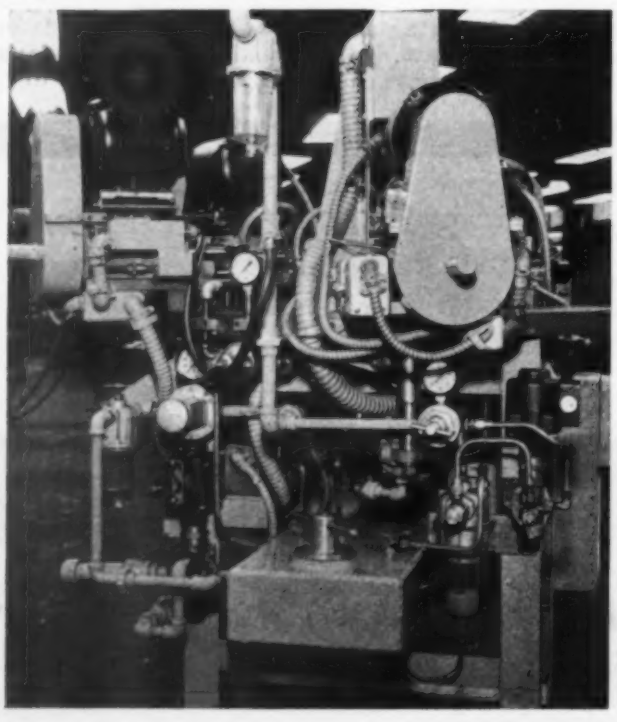
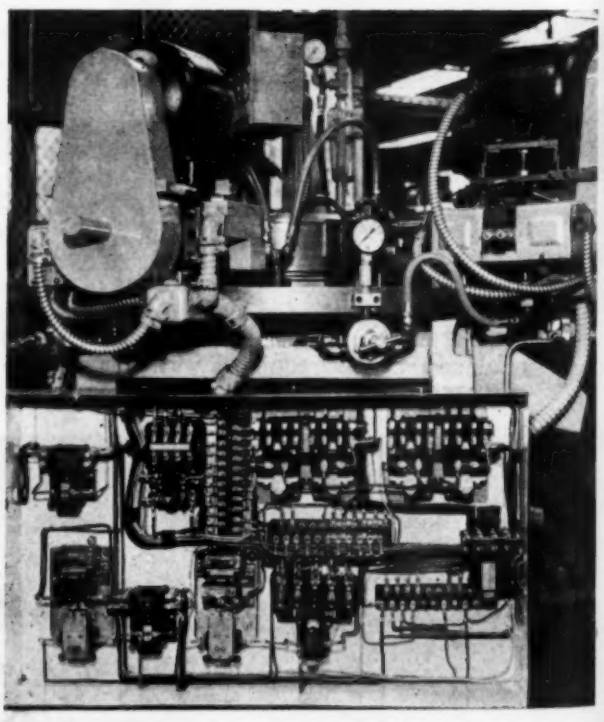
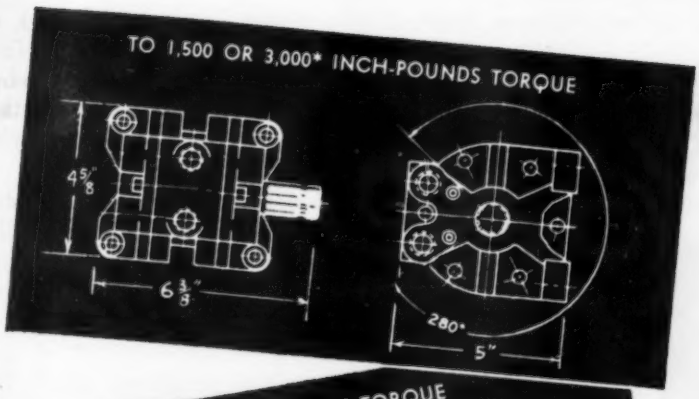
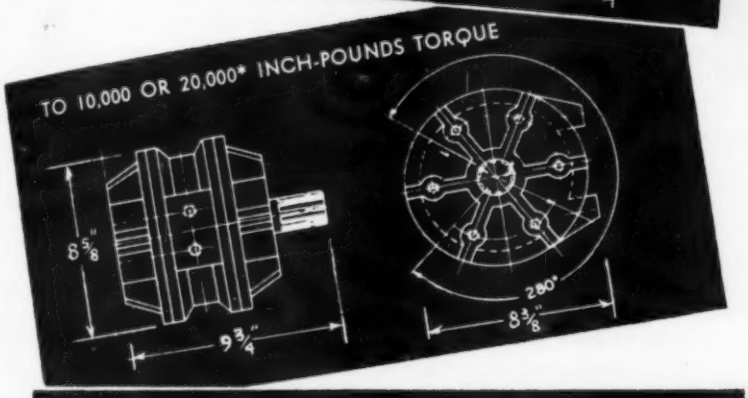
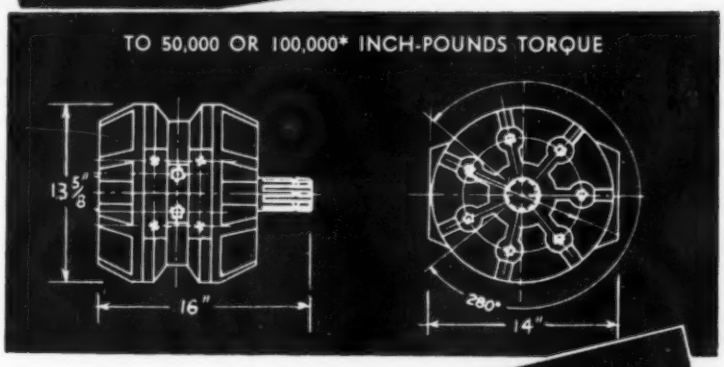


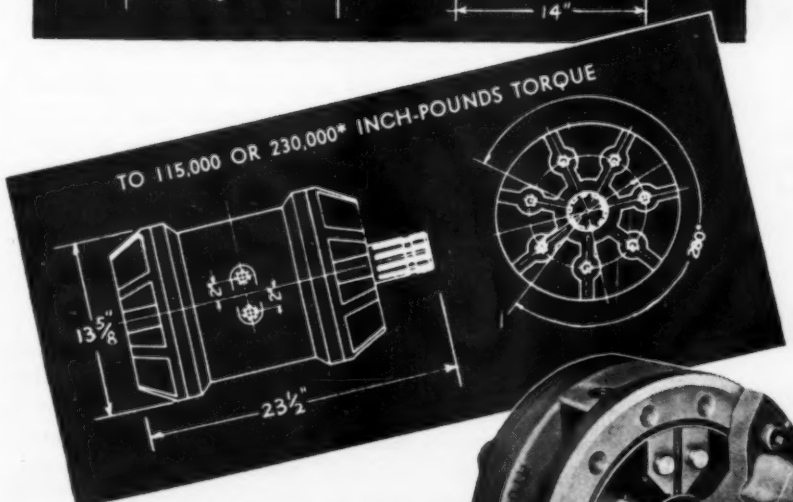
FIG. 4. The central electrical control panel contains magnetic starter, cycle timer, motor reversing relays, delay timer and main switch (left).











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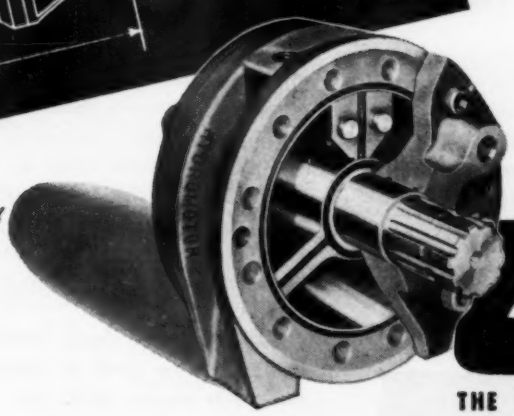

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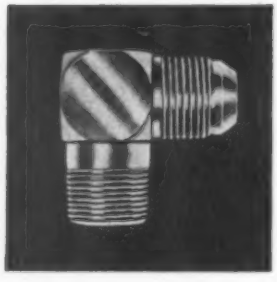

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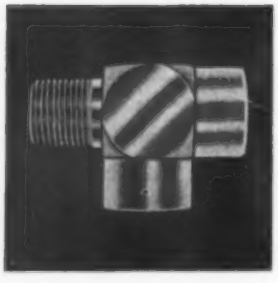

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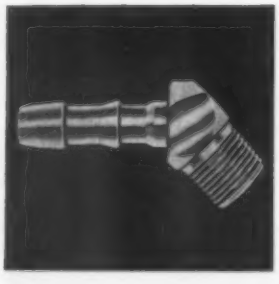

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A control assembly is mounted on the basic spindle unit. A yoke on the forward end clamps to the quill; a slide at the back end has adjustable limit switch trip nuts for setting the forward and return limits of the stroke. Each unit has pressure regulator and exhaust controls for rate of forward and return movement.

The electrical circuit permits operation entirely by hand, i.e., lock pin in or out, index stroke and return, each spindle stroke and return, used primarily during setup and tool replacement, or automatic except for work insertion and removal.

Electrical Safety Interlocks

During automatic operation, the cycle time is determined by the slowest unit work time. When all units have completed their work stroke and automatically retracted, the lock pin withdraws, the table indexes and the return of the lock pin actuates the units for the next working stroke. A cycle timer, set for less than the drilling time, prevents too rapid indexing during any period when no work is being drilled.

Relays serve as safety interlocks and prevent the lock pin from being withdrawn until all units are in their retracted positions. Similarly, relays prevent the start of the next work strokes until the lock pin is again engaged. A time delay switch, set for less than the indexing time, prevents repeat work stroke until the impulse circuit is broken by the withdrawal of the lock pin. Rotation of the tapping units is controlled by reversing switches operated coincidental with the forward and reverse stroke controls.

The tapping units are operated by only sufficient air pressure to advance the tap to and from the work (approximately one pound), allowing the tap to form its own lead screw.

Tool lubrication is accomplished by a coolant vapor sprayed, under air pressure, on each tool. An air pressure line is built into each fixture. The air blast also effectively serves to remove chips. The coolant tank is shown in Figure 3.

The use of this special drilling and tapping machine has eliminated from two to four single operation machines. The floor space saving alone was considerable. With similar four, six and eight spindle machines replacing single operation machines, a production factor of at least two, in terms of floor space was gained. Since the output of the four spindle machine, compared to the output of single operation machines, averaged 400 to 600 percent, the design and machine building time has proven a very sound investment in this shop.

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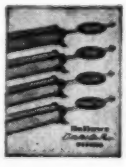

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The Bellows Air Motor illustrated is Model BEM5-25 (2½" bore, 2½" stroke). Other bore sizes are 1", 1¼", 2½", 3⅜" and 4½". Any stroke length. Model shown is equipped with the ELECTROAIRE VALVE for full electrical control. Air Motors with manually operated valves are also available.

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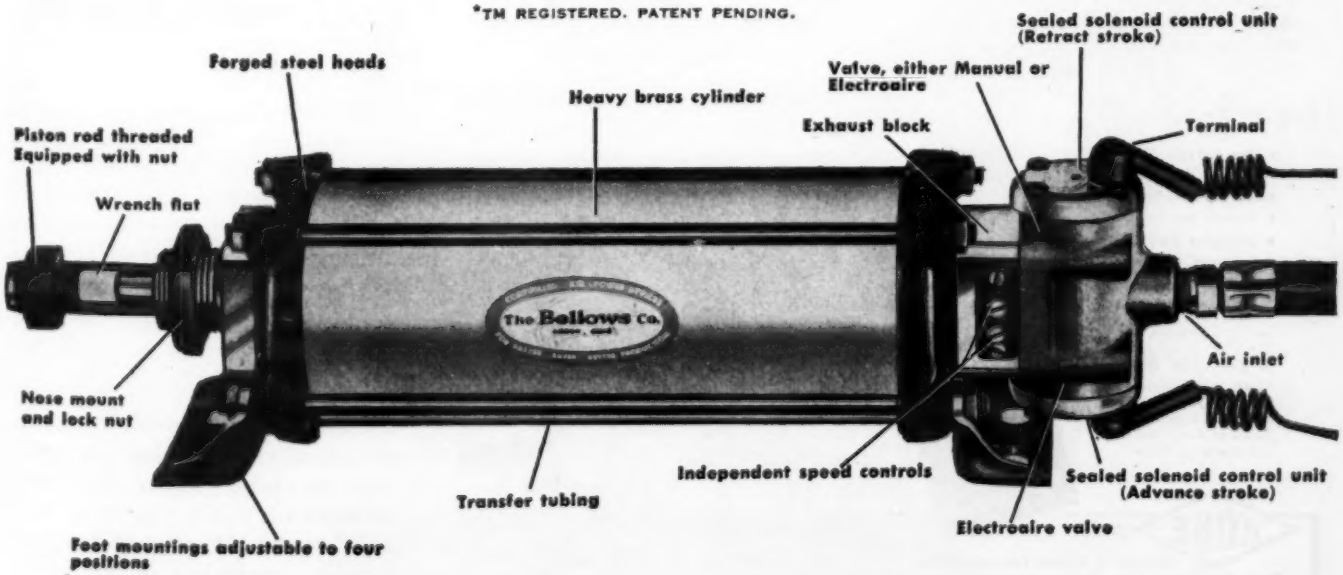

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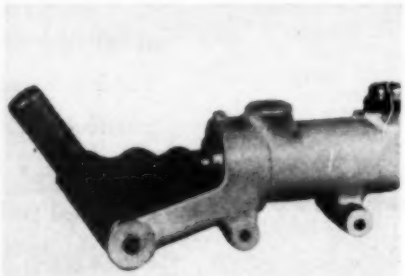
What's New In Components

New Hand Pump

Alten Foundry & Machine Works, Lancaster, Ohio

Design: Aluminum body; stainless steel piston and working



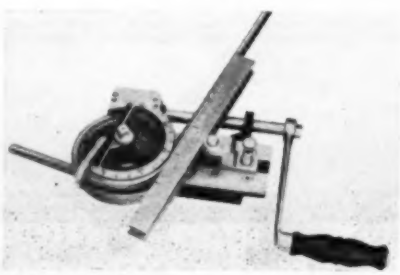
parts. Double check feature holds pressure at any position of stem, socket or extension type operating handle—pre-set and adjustable in two standard sizes: 1500 psi with 1.5 cu. in. stroke displacement; 3000 psi. with .75 cu. in. displacement, or to specifications.

Circle 154 on Reader Service Card

Stainless Steel Tubing Tools

The Imperial Brass Mfg. Co. Chicago 7, Illinois

Application: For making flares and bends on aircraft grade, high strength stainless steel tubing.



Types: Included in the new tools are a flaring tool, a tube bender, a reaming and deburring tool and a sawing vise. The tools are all designed for use with aircraft grade stainless steel tubing but can also be used with steel, titanium aluminum and other metal tubing.

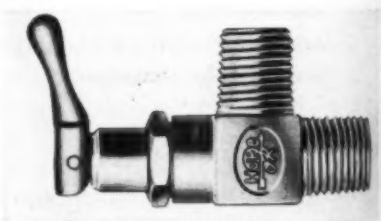
Designation: Flaring tool, No. 400-F- makes 37 degree flares in conformity with aviation standard AND 10061; Bender 600-F; vise is No. 384-F; and reaming and deburring tool is identified as No. 401-F.

Circle 155 on Reader Service Card

Angle Type Toggle Valves

Hoke, Incorporated Englewood, New Jersey

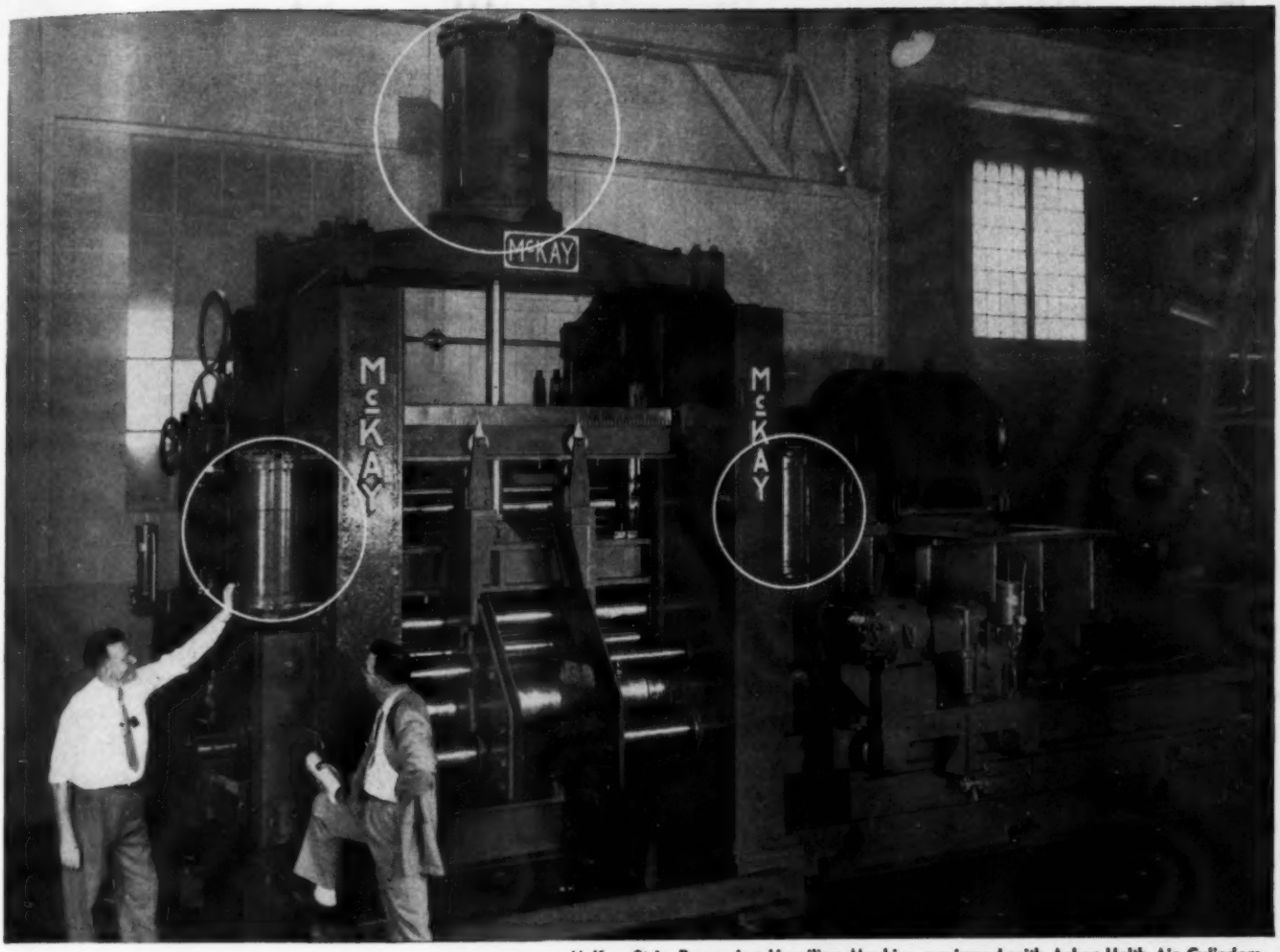
Application: Controlling high vacuum systems or pressures up to 500 psi.



Features: Designed for use in installations where the angle style is more adaptable than straight pattern valves. Can be utilized in any application requiring a quick opening valve having no leakage through stem or seat. They readily replace stopcocks and will not leak under pressure.

Construction: The internal materials of construction are brass and synthetic rubber. Seat material is normally synthetic rubber but can be altered to meet specific conditions of operation.

Circle 156 on Reader Service Card



McKay Strip Processing Uncoiling Machine equipped with Anker-Holth Air Cylinders.

Help yourself to this "CYLINDER KNOW-HOW"

MACHINE designers everywhere find it helpful to call in Anker-Holth engineers on power motion problems. Push, pull, lift or lowering action . . . air or hydraulic power . . . regardless of your problem, feel free to ask for the competent help of the nearby Anker-Holth man!

Specify Anker-Holth cylinders. There is a wide range to meet your specific needs, including heavy-duty types for steel mill equipment such as shown above. Write for bulletin. Anker-Holth Division of The Wellman Engineering Company, 2729 Conner St., Port Huron, Michigan.

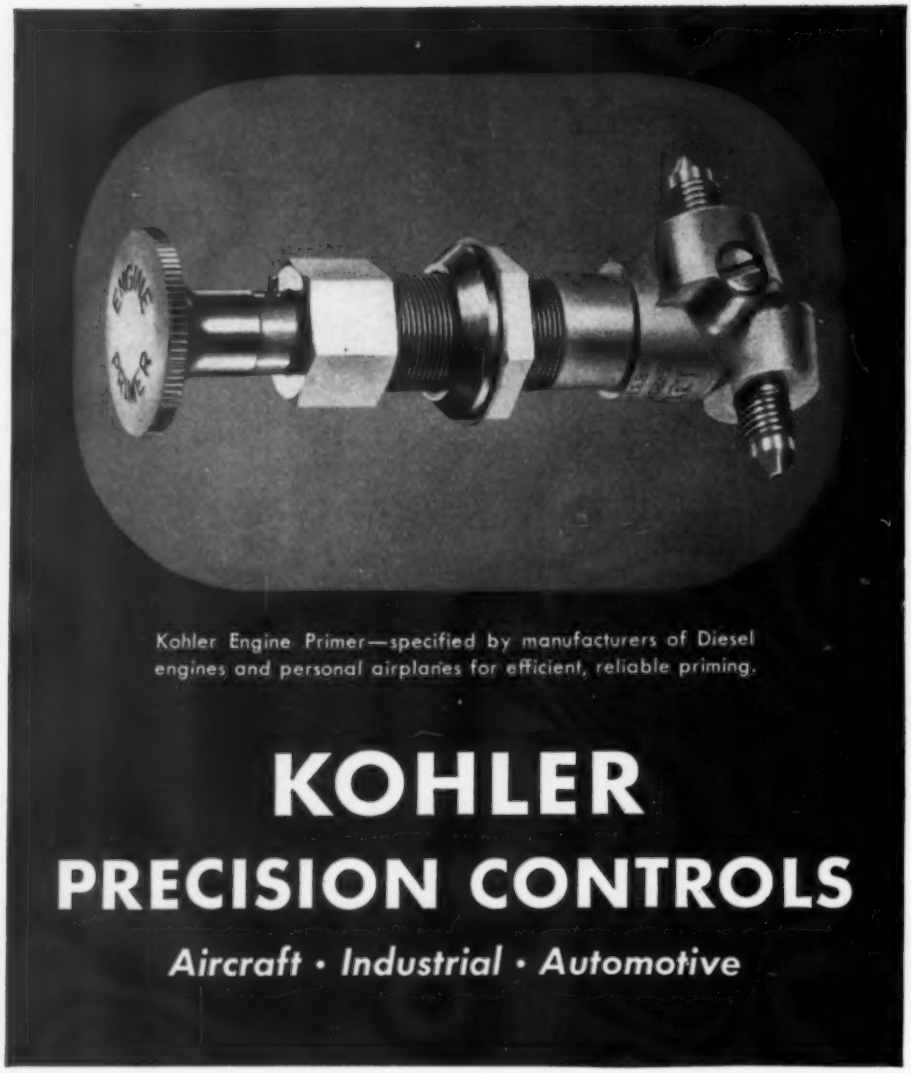
INFORMATION *on the complete line of Anker-Holth products is given in this bulletin. Free on request.*

Anker-Holth

ENGINEERED CYLINDER POWER

WELLMAN

Division of THE WELLMAN ENGINEERING COMPANY



Kohler Engine Primer—specified by manufacturers of Diesel engines and personal airplanes for efficient, reliable priming.

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PRECISION CONTROLS

Aircraft · Industrial · Automotive

Kohler Co. is a leading supplier of precision controls, including pneumatic, hydraulic, fuel valves and fittings, to manufacturers of jet engines, military, commercial and private aircraft, agricultural and industrial test equipment and Diesel engines.

Facilities for forging, die casting, machining, anodizing, are maintained all in one plant—with an experienced organization skilled in precision workmanship.

Our engineers develop, for volume production, controls to specification. Write for illustrated booklet.

Kohler Co., Kohler, Wisconsin. Established 1873

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PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS
AIR-COOLED ENGINES • PRECISION CONTROLS

Check Valve—Lever Operated

Hydraulic Unit Specialities Co.
Waukesha, Wisconsin

Designation: Model 3050 "Husco"

Capacity: 3/8" N.P.T.

Material: Alloy-rust resistant cast iron.

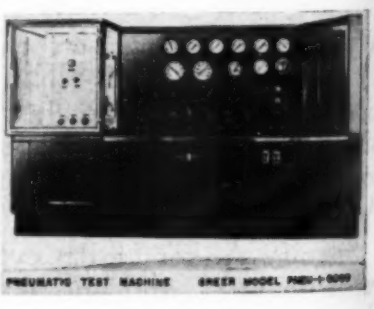
Application: For positive cylinder lock, in hydraulic brake line circuits.

Circle 157 on Reader Service Card

Pneumatic Test Stands

Greer Hydraulics, Inc.
Brooklyn, New York

Application: For testing aircraft pneumatic components and systems.



Construction: Includes either a booster cylinder, or an air compressor with electric motor, muffler and automatic pressure regulators. Supplying the air pressure are several circuits, including the static air circuit for maximum pressure up to 6000 psi; the vacuum circuit with 2 stage 9 cfm capacity vacuum pump capable of producing .001 mm Hg and a vacuum chamber capacity of 700 cu in. The maximum flow conditions are 300

When sirens scream and fire trucks roar through the streets to battle a blaze caused by a hydraulic line breaking in your die-casting plant, it's *too late.* Too late to prevent a fire. Too late to save lost production due to machinery and building damage. Too late, perhaps, to prevent injury or death to employes.

You can reduce the possibilities of such a disaster by switching to Monsanto Pydraul F-9 . . . *now.* You can change to Pydraul F-9 simply by draining the hydraulic system and refilling with the Monsanto product.

Pydraul F-9 is Monsanto's nonflammable-type hydraulic fluid. Under test conditions, it does not flash or ignite when sprayed, dripped or flooded on molten metal heated to approximately 1,500° F., nor does it ignite or flash when sprayed, at 1,000 p.s.i., into the 6,000° zone of an oxyacetylene flame. Users say Pydraul F-9 has prevented fires in their plants.

In addition to increased *safety*, you get *efficiency* and *economy* when you switch to Pydraul F-9. The fluid has high resistance to mechanical shear and chemical breakdown. It is high in lubricity and does not corrode metals from which machines are constructed.

Investigate the increased safety, efficiency and economy of Monsanto Pydraul F-9 today. Contact the nearest Monsanto Sales Office or write for a copy of the 12-page, file-size booklet, "Pydraul F-9." MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle, Twin Cities. In Canada, Monsanto Canada Limited, Montreal.

Pydraul: Reg. U. S. Pat. Off.

PYDRAUL F-9

MONSANTO
CHEMICALS—PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

Circle 79 on Reader Service Card

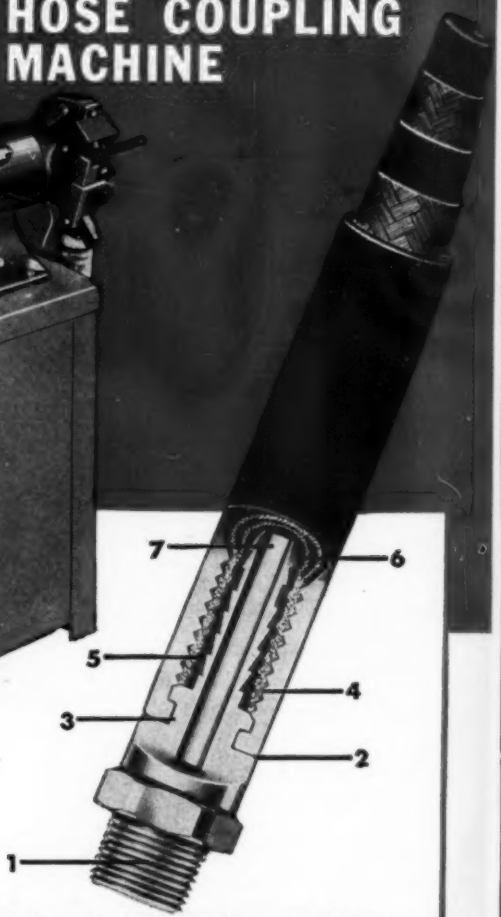
Save time... Cut costs!

MAKE YOUR OWN HYDRAULIC HOSE ASSEMBLIES WITH PERMANENT COUPLINGS FOR GREATER PRESSURES

WITH A **PYLES** HOSE COUPLING MACHINE

New revolutionary low-cost machine helps you *cut production costs*—and avoid delays—by fabricating your own permanent hydraulic hose assemblies quickly, easily, in your shop.

Pays for itself in a matter of weeks! Does complete assembly and swaging job. Produces a finished hose, coupled at both ends, in 4 minutes. The Aro 2-piece steel coupling used in the process takes greater pressure, prevents breathing, resists corrosion, gives you a BETTER hose assembly than you've ever seen before! Write today for bulletin No. 8; for hose assembly only, bulletin No. 9



COUPLE BOTH ENDS IN 4 MINUTES

1. Made of STEEL, superior to other metals, retaining maximum swage.
2. Two-piece construction permits better design and machining.
3. Stem and ferrule LOCKED permanently in assembly.
4. Deep, opposed barbs mechanically create chevron-type seal.
5. Strong serrations grip inside and outside hose diameter.
6. Cold flow of rubber tube stock ELIMINATED.
7. No more restricted flow caused by extrusion of tube.

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Manufacturers of . . . Couplings • Lubricators • Filters • Hose • Hose Fittings • Flowmeters • Hose Assemblies Lubricating Systems • Pumps • Valves

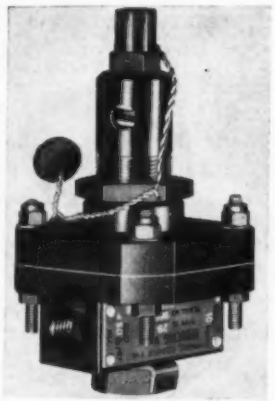
cfm at 5000 psi using a booster cylinder. The test stand also includes an after cooler assembly and moisture eliminator. A receiver tank is supplied to give a steady flow of compressed air. Electrical equipment is suitable for operation on 220/440 volts; a 24 v dc power source can be furnished.

Circle 158 on Reader Service Card

Reducing Valve

The Hymatic Engineering Company Ltd.
Redditch, Worcs., England

Designation: PS 29



Application: Designed to work within the pressure range of 450 psi maximum input and 10 psi maximum output at temperatures ranging between —50 degrees C and 120 degrees C, it weighs only 0.38 pound.

Circle 159 on Reader Service Card

Rotating Limit Switch

Furnas Electric Company
Batavia, Illinois

Designation: Style L-3464

Application: Used to limit the travel of rotating parts of machines, operating doors, hoists or valves. Coordinates reversing operations with the rotation of the motor shaft, or other operating shaft, to break contact, timing of which is governed by a preset number of shaft revolutions.

Construction: Consists of two

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MARSH BEST SINCE 1900 LEATHER PACKINGS

MARSH research leads again with a new *improved* quality impregnated mechanical leather!

Marsh leads in better Leather Packings, because –

- Only packing leather specifically tanned to Marsh rigid specifications is used.
- Marsh continuing research on impregnations and quality control give you new packing material values – to improve the efficiency and acceptance of your products.

Marsh research has developed new, tougher – wear, age and extreme temperature resistant – mechanical leather packings which combine resilience and tightness with low friction.

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If you seal oil, water, air, vacuum, gas, gasoline, naptha, alcohol or other fluids, ask Marsh for field engineering service.

FEATURES: Low coefficient of friction — both static and running, greater wear resistance, tighter sealing, better high and low temperature stability, improved lubrication potentials, longer life.

• Write for Engineering Handbook and technical literature

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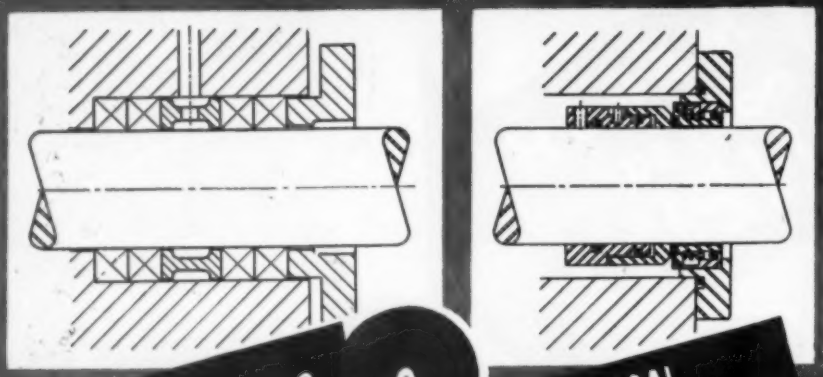

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MECHANICAL SHAFT SEAL?

MAKE IT A MECHANICAL SHAFT SEAL...

- For sealing pressure differentials—high or low
- For sealing to prevent loss of valuable products
- For sealing shafts in inaccessible locations
- For sealing inflammable or explosive fluids
- For sealing shafts where there is not enough space for a stuffing box
- For sealing shafts which must operate for long periods of time without attention or maintenance
- To eliminate shaft wear at the point of sealing

MAKE IT SEALOL

. . . the compact rotary seal with the patented balanced-pressure design. Let us put our years of shaft sealing experience to work on your problem — whether it's sealing a pump, hydraulic motor, gas turbine, main shaft, gear box, or any rotating shaft. Send blueprints and job description to Sealol Corporation, 45 Willard Ave., Providence 5, R. I.

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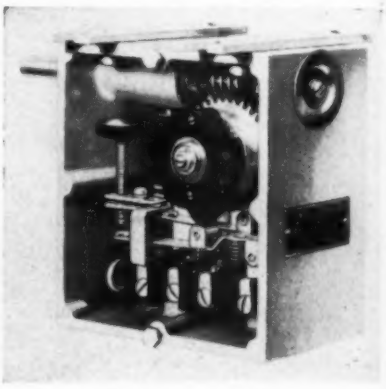
(In Canada: Lyman Tube & Bearings, Ltd., Montreal, Toronto, Winnipeg)

SEALOL

The Balanced Pressure Seal

separate switching units each operating by a cam. Cams engage with contact arms to open or close a circuit for each end of travel. Cams are mounted on either side of a die cast gear which in turn is driven by a



worm gear attached to a shaft operating through the switch case.

Size: 6 1/8 in. high, 4 3/4 in. deep, 5 3/8 in wide.

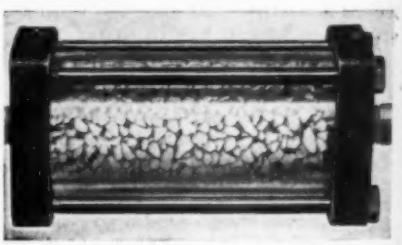
Rating: Standard duty, 3 amps, 110 v ac; 1.5 amps, 220 v ac.

Circle 160 on Reader Service Card

Air Line Moisture Indicator

King Engineering Corp.
Ann Arbor, Michigan

Size: Over-all dimensions are 5" long x 2-5/16 square. Pressure drop is less than 1 inch of water at a flow rate of 5 cubic feet per minute.



Operation: This unit consists of a pyrex glass cylinder filled with moisture sensitive blue granules, and has end plates tapped for ¼" pipe. In operation, it is placed in the line between the air supply and the point at which the air is used. The granules stay blue as long as the air leaving the indicator is dry, and turn pink when it contains moisture or water vapor.

Circle 161 on Reader Service Card

Circle 74 on Reader Service Card

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-the finishing touch to a good product

Through long experience the users of your product have learned to respect the lasting accuracy of Marsh — the greatest name in pressure gauges. A Marsh Gauge on your product is truly a mark of quality.

The Marsh line embraces pressure gauges and dial thermometers of every required type, construction, size, range, finish.

Ask for this catalog covering your instrument requirements

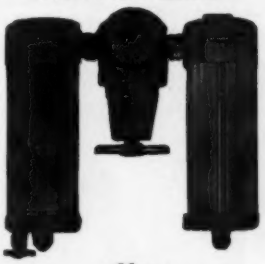
MARSH INSTRUMENT CO.

Sales affiliate of Jas. P. Marsh Corporation, Dept. 19, **Skokie, Ill.**
Export Dept., 155 E. 49th St., New York, N. Y.

Circle 72 on Reader Service Card

"M-B" AUTOMATIC Air Line FILTER, REGULATOR and LUBRICATOR ASSEMBLY

"Sentinel of the Air Line"



Also Pneumatic Grinders

"Remember, Built-in quality remains long after first-cost disappears."

FILTER element removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR is capable of passing large volume with an unrestricted flow and minimum amount of pressure drop. Self-bleeding, compact, simple. Machined from bare aluminum. LUBRICATOR delivers desired volume of oil. Adjustable Venturi Valve permits efficient operation on broad range of volume and pressure. Bowl can be refilled without shutting off air supply. Any of these 3 devices can be used as separate units or in any combination.

Write for Literature

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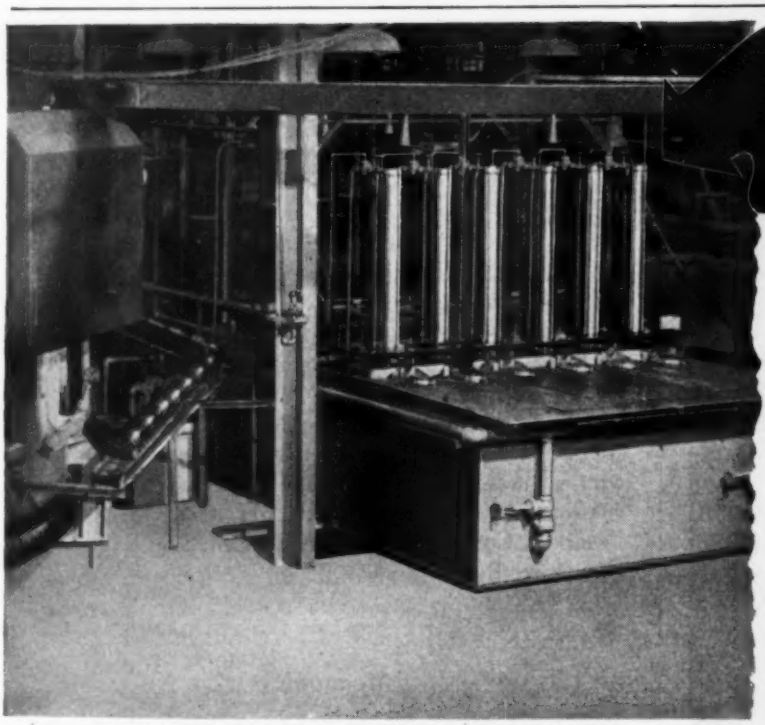
DETROIT 3, MICHIGAN



View of Heat Treating Department, at Gas Machinery Company, shows NOPAK Cylinders which dip baskets of parts into quenching tanks.

Quench Dipping with NOPAK Cylinders

Expedites Heat Treating Cycle

At the Gas Machinery Company, Cleveland, Ohio, work-pieces are conveyed from the heat treating furnaces into wire baskets which are then immersed into a quenching bath by a series of NOPAK Cylinders mounted vertically above the quenching tank. After quenching, the baskets are lifted out of the tank by the cylinders, and the parts are transferred to another conveyor, with the aid of another NOPAK Cylinder, for further processing.

This installation is typical of the many materials-handling operations in which NOPAK Valves and Cylinders are used. For others see the NOPAK Application Manual.

GALLAND-HENNING MANUFACTURING CO.
2743 SOUTH 31ST STREET MILWAUKEE 46, WISCONSIN

Refer to Sweets File for Product Designers or write for Bulletin SW-1

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NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

A 7283-½-H

custom-designed for strength and sensitivity

In Honeywell control valves, a Linear Precision-molded diaphragm provides the combination of strength and sensitivity demanded by modern process control. It translates the slightest change in air pressure into a related motion of the valve stem. Custom-engineered for this job, the diaphragm lasts for millions of cycles... retains its sensitivity... takes heavy overloads and temperature changes in stride.

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New Books

Tractors and Their Power Units

Essentially a text book for professional agricultural engineering courses, the four authors (W. M. Carleton, E. G. McKibben, Roy Bainer and E. L. Barger) have selected material from many excellent technical papers and manuals to provide a thorough, practical book. Each of the component parts of the modern farm tractor, including engines, valves, clutches, brakes, hitches, transmissions, power take-offs and hydraulic controls, are briefly but adequately treated. References and problems are provided for further study and understanding.

"Tractors and Their Power Units" is one of a series in the field of agricultural engineering sponsored by The Ferguson Foundation. The book is published by John Wiley & Sons, Inc. at $6.50.

Automatic Feedback Control

This excellent manual is designed for the engineer who wishes to gain greater proficiency in automatic control. Written by two manufacturers of control equipment, William R. Ahrendt, President, The Ahrendt Instrument Co. and John F. Taplin, President, Kendall Control Corporation, it achieves a good balance between theory and practice.

The first six chapters were originally published informally in 1946 under the title "Automatic Regulation". These chapters cover the field of feedback theory of different types of control systems. Problems are provided for each of these chapters so the student may work out typical and specific control problems.

The seven following chapters have been assembled to enhance the usefulness of the first chapters by treatment of very practical aspects of the design and analysis of control systems. Numerous examples of feedback control systems from the author's own experiences are given. Unique features include the treatment of multiple-loop systems, the analysis of discontinuous control systems, the analysis of pneumatic controllers and the systematic and quantitative discussions of industrial control systems. "Automatic Feedback Control" is published by McGraw-Hill Book Company, Inc.

Mechanics

J. L. Meriam, associate professor of engineering design at the University of California has authored two volumes on mechanics. "Statics," the first of the two volumes, integrates the usual pre-engineering background of physics, mathematics and graphics. The author progresses in easy stages from fundamentals to advanced theory. He emphasizes the importance of principles and problems which apply them. The author includes 672 practical problems. Answers

are given for more than half of these problems, and all are profusely illustrated.

In the second volume, "Dynamics," full use of graphic procedures is made whenever they are of advantage.

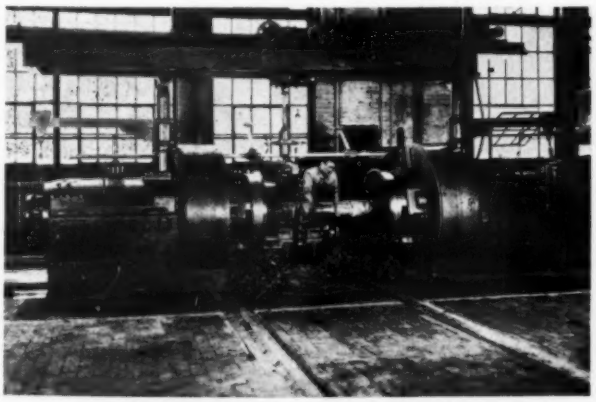
These up-to-date presentations will be valuable additions to the practicing engineers library of basic texts.

Each volume, priced separately at $4.00, is available from John Wiley & Sons, Inc.

"Big Mo" Wheel Lathe Uses Oil Fed Tooling

THE largest, fastest, and most modern car wheel lathe ever used by the Philadelphia Transportation Company was installed recently in its Fern Rock Shop for maintenance of subway and elevated cars.

Substantial economies in car maintenance are being affected not only because of higher speed operation but because automatic cutting and profiling controls make a better job with less attention than previous methods. Also, cars are being returned to service more quickly.



TWO 36 INCH car wheels and axle are turned in 28 minutes including load and unload time.

Known as the "Big Mo" by the men at Fern Rock, the new 70 ton Niles 52 inch car wheel lathe is a product of Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. Profiling equipment, hydraulic feeds, and power driven chuck enable turning down a pair of 36 inch car wheels (two wheels and axle) with carbide tools in 28 minutes. This includes time for pick up and return to the floor by a hoist.

Wheels on PTC cars are checked frequently for wear and must be turned down a number of times during an average life of 200,000 miles or five years. Original standard contour of tread and flange is renewed by means of a stylus which follows a template having a profile duplicating that of a new wheel.

Hydrohoner—product of Micromatic Hone Corporation, Detroit, Mich.

Snap-Lock Limit Switches

Over 90% of the nation's leading machine tool builders have standardized on Snap-Lock Limit Switches for use under the extremes of heavy-duty service. Quick, positive action in indexing the work-table—and completely dependable long-term service—are the reasons Snap-Lock Limit Switches were selected for this Hydrohoner application. *Snap-Lock Limit Switches are built in a variety of types and sizes to suit every industrial application; special mountings are available.*

For more information on Snap-Lock Limit Switches, ask for Engineering Bulletin EM-51.

Namco "Stellite"-Welded Solenoids

High-speed action and exact control of critical motions are characteristics that have been performance-proved by hundreds of users of Namco "Stellite"-Welded Solenoids. Typical of this precision service is their application to govern the hydraulic movement of the twin spindle heads of the Hydrohoner illustrated, product of the Micromatic Hone Corporation. *Namco Solenoids are available in push or pull types (up to 25 pounds) for either A-C or D-C service in a variety of standard mountings, to meet almost every industrial application.*

For more information on Namco Solenoids, ask for Engineering Bulletin EM-52.

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THE NATIONAL ACME CO.

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What's NEW in useful Free literature

To get your reference copies use the postcard bound in this issue.

Hydraulic Valves . . . Three-way selector, 2-way diverter and shut off valves are the subject of a 4-page Catalog 1B-2, issued by Barksdale Valves. The shear seal principle employed in these valves, provides for positive leakproof control of air water or hydraulic oil. Shown in the bulletin are dimensions, sizes and flow diagrams.

Circle 201 on Reader Service Card

Control Valves . . . A 20-page general Catalog 1500 B, describing fluid control valves, has been published by the Annin Company. The various models of valves are discussed and sectional drawings show construction features. The catalog also contains flow formulas for liquids, gases and steam as well as general specifications.

Circle 202 on Reader Service Card

Heat Exchanger . . . Niagara Blower Company has published a 4-page bulletin illustrating the various applications for the Aero heat exchanger. It is a simple method of cooling or controlling the temperature of a liquid or gas, the exchanger is kept free from contamination with outside air which would otherwise cause accumulation of salts and acids in the cooling water.

Circle 203 on Reader Service Card

Hydraulic Cylinders . . . Lindberg Engineering Company has released a new 28-page two color Bulletin No. 701, covering hydraulic cylinders. The bulletin covers a complete line of cylinders. Diagrams, photos and charts explain the different mounting types and capacities up to 1500 psi and 3000 psi working pressure.

Circle 204 on Reader Service Card

Reciprocating Rotary Actuator . . . Bulletin 21 published by the Hydromotor Division of the Bonnot Company, discusses the wide range of standard and special models of the Hydromotor, a reciprocating rotary actuator employing air, oil or other proper fluid medium. The Hydromotor provides equal power in either direction. It can be readily controlled as to speed or arc of travel and shows an efficiency easily comparable to other types of hydraulic systems for similar duties. The bulletin discusses all advantages and applications are illustrated. A two page spread in the catalog covers schematic application diagrams showing the versatility of the unit. Construction and operating features are detailed and engineering data for the various models is given.

Circle 205 on Reader Service Card

Air Cylinders . . . Miller Motor Company has released new Bulletin A-105G describing air cylinders. The bulletin contains complete engineering, design, construction and mounting data, including all mounting drawings and dimension tables covering 13 different mounting styles in 1½" through 14" bores. The bulletin is designed so that a user can quickly select a model and obtain the dimensions generally without even having to turn a page. For even greater simplification and convenience all the mountings are shown in color right on the drawing. The bulletin covers cushioned and non-cushioned cylinders, single and double acting, single and double rod; spring return and over-sized rod cylinders.

Circle 206 on Reader Service Card

Oil Filters . . . Honan-Crane Corporation has issued two new 4-page bulletins. One folder explains in detail how filtration and handling equipment keeps oils and coolants in a safe condition, eliminates shutdowns, equipment damage and production delays caused by contaminated oil. The bulletin presents a complete line of oil and coolant filters, clarifiers and conveyors. The second booklet describes and illustrates with pictures and diagrams typical individually engineered oil filtration and handling systems. Also contained are case histories.

Circle 207 on Reader Service Card

Circle 10 on Reader Service Card

BARCO
High Pressure
SWIVEL JOINTS

for
HYDRAULIC SERVICE
Tubing or Pipe

NO BINDING—A Barco design advantage! "Side Flexibility" in joint compensates for misalignment; simplifies and speeds up installation.

LEAKPROOF—A choice of precision-made seals for highest pressures, temperatures, and steam or corrosive service.

SMALL, LIGHT, COMPACT—Standard models for ¼", ⅜", ½" and ⅝" O. D. tubing (A/N, flared, or Ermeto) or comparable size pipe threads. Angle or straight connections.

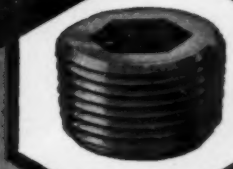
PRESSURE SAFE—The seal will not break or blow out suddenly. Built to 3000 psi working pressure standards, steel or aluminum. *Send for literature.*

BARCO MANUFACTURING CO.
1832 M Winnemac Avenue, Chicago 40, Illinois
In Canada: The Holden Co., Ltd.

Circle 5 on Reader Service Card

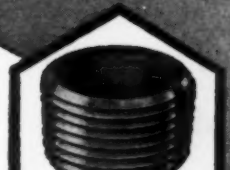
Standard sizes range from 1/16" to 1½".

ALLEN
Tru-Round
PIPE PLUGS



- Burr-free threads
- Full Pressur-forming
- Tru round — uniform taper
- Available in Dryseal and Standard threads

Allen Dryseal Pipe Plugs used with N.P.T.F. threading will withstand up to 3000 lbs. pressure without leaking, making them particularly valuable for refrigeration, hydraulic and similar equipment. Allen Standard Pipe Plugs for use with A.N.P.T. threading provide a perfect seal without sealing compounds at ordinary pressures.



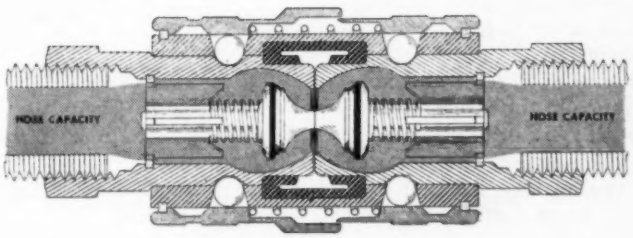
SOLD ONLY THROUGH LEADING INDUSTRIAL DISTRIBUTORS

THE **ALLEN** MANUFACTURING COMPANY
Hartford 2, Connecticut, U. S. A.

Bruning
QUICK-DISCONNECT COUPLERS

QUICK-SIMPLE-POSITIVE COUPLING AND UNCOUPLING
There is no spurting or loss of oil either when coupling or uncoupling. No oil gets out—No dirt gets in.

SIMPLE AND POSITIVE "AUTOMATIC BREAK-AWAY"
Available for either single or multiple line systems. Standard or pressure couplers easily convert to "Automatic Breakaway."



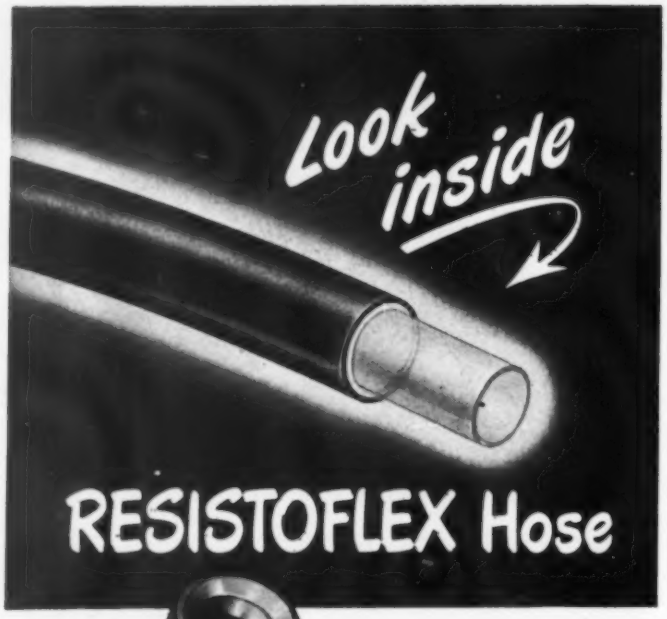
FULL FLOW, POSITIVE SEATING VALVE DESIGN
Specially designed patented sealing system. Guaranteed not to leak either coupled or uncoupled.

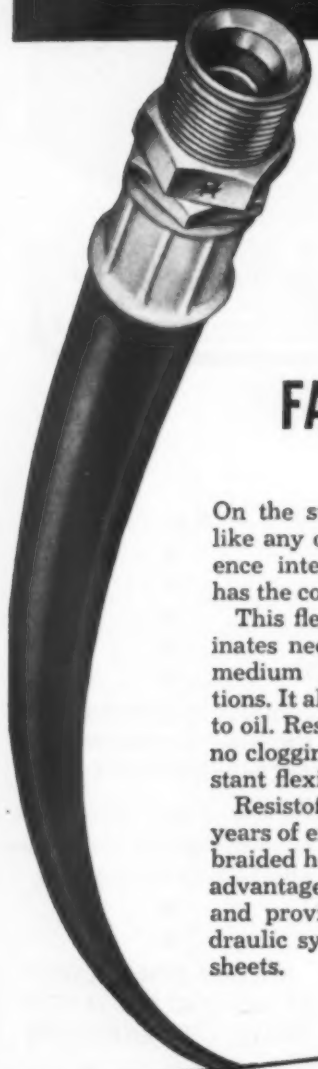
SIZES AND TYPES FOR EVERY APPLICATION
Full capacity couplers for all line sizes from ⅜" to 1".

EASILY COUPLED OR UNCOUPLED WITH FULL PRESSURE ON THE LINES
No special tools, gadgets or brackets required. Easily coupled by hand to 3,000 PSI.

SYSTEM COMPLETELY SEALED AND PROTECTED WHEN DISCONNECTED
No oil gets out—No dirt gets in. No special caps, plugs or other gadgets needed.

THE BRUNING COMPANY
Lincoln, Nebraska





...and you'll see why it's

OILPROOF!

FATIGUE-PROOF!

On the surface, Resistoflex hose looks like any other hose. But what a difference internally. Only Resistoflex hose has the compar tube.

This flexible, high tensile tube eliminates need for metal reinforcement in medium pressure hydraulic applications. It also makes the hose *impervious* to oil. Result: No erosion, no gumming, no clogging. And no fatigue under constant flexing conditions.

Resistoflex has proved skill and long years of experience in the fabrication of braided hose with synthetic tubes. Take advantage of the quality this assures and provide trouble-free, cleaner hydraulic systems. Write for specification sheets.

For out of the ordinary engineering with synthetics

RESISTOFLEX

RESISTOFLEX
CORPORATION
Belleville 9, New Jersey

Safety Hydraulic Fluid . . . A 12-page booklet on Hydrolubes has been published by Carbide and Carbon Chemicals Division of Union Carbide and Carbon Corp. Hydrolubes were developed to meet the need for hydraulic oils which could be used in locations where fire hazards exist. The booklet contains charts of physical properties, viscosity and temperature, outlines the advantages and shows how to use hydrolube fluids.

Circle 208 on Reader Service Card

Precision Switches . . . Catalog 82 issued by the Micro Switch Division of Minneapolis-Honeywell Regulator Company, illustrates precision switches, primarily for use in alternating current circuits in industrial applications. All switches featured are illustrated; construction and operating characteristics are outlined.

Circle 209 on Reader Service Card

Hose Assemblies . . . Catalog No. 52 issued by the J. N. Fauver Company covers assemblies, couplings, stems, swivels and accessories. Complete specifications are given and illustrations show a broad line of industrial application. Various types of hose, designed for intermediate and very high pressure, for ordinary and elevated temperatures, for excessive flexing and rough handling are also outlined.

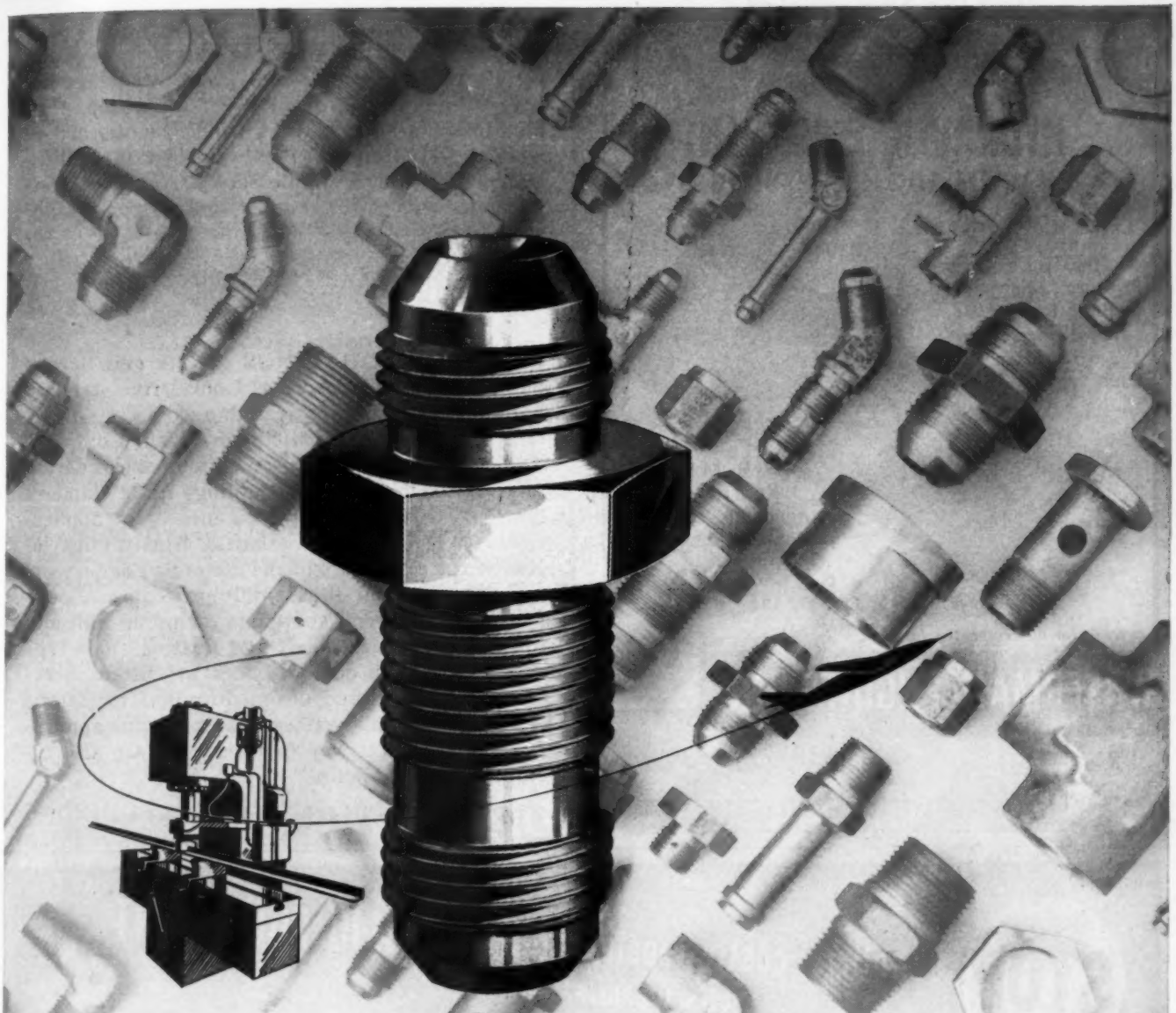
Circle 210 on Reader Service Card

Air Separator . . . A descriptive bulletin containing technical data for selection, installation and operation of air separators has been prepared by Chicago Manufacturing and Distributing Company. The unique arrangements of the cleaning units of the air separator completely eliminates maintenance, because there are no filters to replace, no baffles to clean, no moving parts to wear. Available models, capacities and sizes are listed.

Circle 211 on Reader Service Card

Regulators and Controllers . . . Catalog SW is a comprehensive 12 page bulletin featuring products manufactured by Fisher Governor Company. The catalog, which is well illustrated, shows the following type of controls: pressure regulators, direct operated, self contained and pilot operated; diaphragm control valves; pump governors; gas regulators; liquid level control; lever and float valves; traps, strainers and filters; and special control valves. All size ranges, specifications and construction are detailed.

Circle 212 on Reader Service Card



FITTINGS THAT PASS THE TEST

For aircraft, hydraulic and industrial applications *where there must be no doubt of precision and strength!* You get assurance of such critical accuracy from Dumont. Every conceivable test *certifies* the quality. To quote your next requirements call on Dumont, an approved source, for fittings and hardware in virtually every AN number.

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Circle 122 on Reader Service Card

Protect

HYDRAULIC EQUIPMENT
WITH HIGH PRESSURE
MICRONIC FILTERS

• 3000 p.s.i. Operating Pressure, Micronic Filtration, Low Pressure differential, Compact in Line Type.

• Maximum Protection at minimum cost. Replaceable element.

• Built-in Relief Valve.

Write for illustrated circular A

WATERMAN ENGINEERING Company
725 CUSTER AVENUE • EVANSTON, ILLINOIS

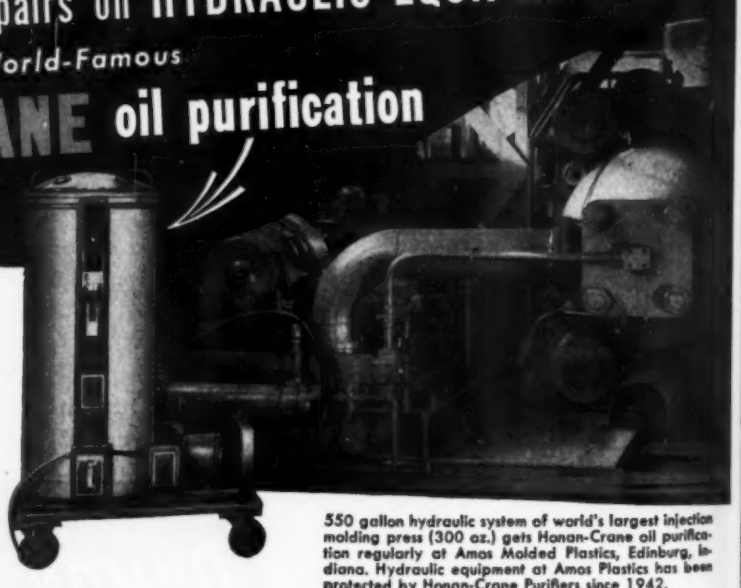
5000 PSI PISTON PUMP . . . Here is a 4 page bulletin describing American Engineering Company's Hydramite, a radial piston, constant delivery, high pressure, oil hydraulic pump. The bulletin lists nine features which are distinctive with the Hydramite. Pendulum action is illustrated by use of a simple sketch. Complete performance curves for the 3, 5 and 10 gpm pumps are plotted.

Circle 213 on Reader Service Card

FLEXIBLE COUPLINGS . . . A new 4 page bulletin, CDC-52, describes Cone-Drive standard bore flexible couplings available from Cone-Drive Gears, Division of Michigan Tool Company. Tables list capacities, specifications and ordering information for flexible couplings in 22 standard bore sizes from ¾ in to 6½ inches for applications on electric motor shafts. Illustrations include exploded views of the coupling components and assembly and disassembly procedures. Specifications for special couplings including mill motor, spacer vertical shaft and floating shaft type designs, all with custom bores, are listed. Service factor tables and design formulas for selecting correct coupling sizes to suit various applications and horsepower requirements are also included in the bulletin.

Circle 214 on Reader Service Card

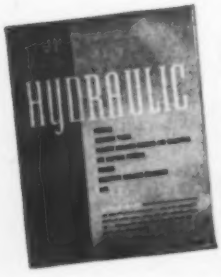
STOP downtime, costly repairs on **HYDRAULIC EQUIPMENT**
with World-Famous
HONAN-CRANE oil purification



70% OF TROUBLE ON HYDRAULIC EQUIPMENT IS CAUSED BY OIL CONTAMINATION AND FAILURE

Honan-Crane Purifiers prevent trouble before it starts in hydraulic installations by keeping oil clean and free from damaging contamination. When used to replace ineffective methods or where no purification program has been practiced previously, 50% reduction in hydraulic maintenance costs and 4 to 5 times the former safe oil life are common experiences.

Honan-Crane Purifiers prevent excessive wear of hydraulic pump parts . . . prevent clogging and sticking of control valves, pistons and other hydraulic mechanisms . . . greatly extend the safe-use life of hydraulic oils. Specify Honan-Crane Oil Purification for your hydraulic equipment. Proven by years of dependable service throughout the world . . . there's no reason to settle for less!



FREE! 8-page "Hydraulic Bulletin" with case histories describing profitable advantages of Honan-Crane Purification in many critical hydraulic applications. Write for your copy!

All Honan-Crane equipment is sold on a performance guaranteed basis

550 gallon hydraulic system of world's largest injection molding press (300 oz.) gets Honan-Crane oil purification regularly at Amos Molded Plastics, Edinburg, Indiana. Hydraulic equipment at Amos Plastics has been protected by Honan-Crane Purifiers since 1942.

Honan-Crane Corporation
102 Wabash Avenue, Lebanon, Indiana
A Subsidiary of
Houdaille-Hershey Corp.

WORLD'S LEADING OIL FILTER MANUFACTURER

SILICONES . . . Want to know more about silicone fluids? Dow Corning Corporation has published a 30 page booklet titled the "Dow Corning Silicone Notebook". The booklet gets right down to fundamentals. Over 20 different properties, from boiling point to sound transmission, are thoroughly discussed and illustrated. References are given and even a blending chart for intermediate viscosities is included. Dozens of current industrial applications are pictured and described.

Circle 215 on Reader Service Card

ALLOY STEEL CHART . . . Peter A. Frasse and Co., Inc., has made available a new chart with which alloy steel specifications can be easily identified. The chart shows chemical analysis for each of 70 Military, Army, Navy Aeronautical and Federal specifications. Also listed are specified forms (sheets, bar, tubing, etc.) and nearest corresponding SAE, AISI and AMS type numbers. Printed on durable cardboard stock, the chart is regular file card size, and can be kept handy for ready reference.

Circle 216 on Reader Service Card

PACKINGS FOR HYDRAULIC AND AIR APPLICATIONS . . . Albert Trostel Packings, Ltd. has published a 24 page catalog describing their development and productive facilities and detailing their line of leather and rubber packings. Drawings illustrate applications and dimensional requirements for cup, flange, U, V and special packings. The data on packings is divided into two sections; one devoted to hydraulic packings, the other to packings for pneumatic systems.

Circle 217 on Reader Service Card

AERO TEST-STANDS . . . Featuring seven modifications of Aero Test-Stands and interesting ways of testing components, a new Bulletin, lithographed in three colors, has been produced by U. S. Electrical Motors, Inc. It tells how test-stands with variable speed can be profitably and scientifically used in testing magnetos, generators, alternators, hydraulic pumps, constant speed drives, actuators, etc. Ranging in rating from ¼ to 70 horsepower, the test-stands have output speeds up to 15,000 rpm. Dual heads are shown which enable a tester to test two components simultaneously. New design features include Orifeed, a method of measuring the amount of lubrication to the gearing. Graphs show comparisons of variable speed systems, load ratings and relative speeds. The new Varitrol system of maintaining a predetermined speed regardless of load is also described.

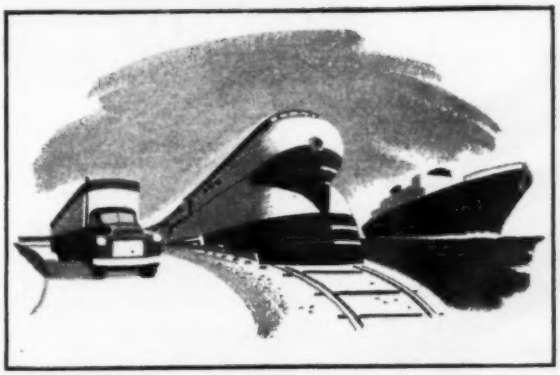
Circle 218 on Reader Service Card

Bendix-Skinner

ORIGINATOR OF **MICRONIC** FILTRATION

the Finest

Answer to Any Filtering Problem



For over twenty years ***Bendix-Skinner*** has specialized in solving the filtering problems that "couldn't be done." From this experience has come entirely new and exclusive filtering techniques which do even the work-a-day filtering jobs better and at lower long-range cost. Tell us about *your* problem—nine times out of ten ***Bendix-Skinner*** filters will supply the "finest" answer.

***Over 350 Models** providing filtration from ½ micron (.000019") upwards at flow rates from 1 to 5000 g.p.m.*

SKINNER PURIFIERS DIVISION OF
1500 TROMBLY AVENUE,
DETROIT 11, MICHIGAN
Bendix AVIATION CORPORATION
Export Sales: Bendix International Division, 72 Fifth Ave., N. Y. 11, N. Y.

Circle 104 on Reader Service Card

POWER...

• ECONOMICAL
• RUGGED
• VERSATILE

Flange Mounting

Double End Rod Mounting

Trunnion Mounting

LINDBERG AIR & HYDRAULIC CYLINDERS

Base Mounting

Foot Mounting

Rabbet Mounting

Pendulum Mounting

For Pulling—Pushing—Lifting—Forcing—Clamping—Pressing

Whether it's one of the 12 standard bore sizes in one of the seven mounting types — or a special cylinder built to your specifications — there's a Lindberg Air or Hydraulic cylinder for your specific need.

Remember — Lindberg cylinders effect great savings through the reduction or elimination of costly mechanisms formerly needed for a variety of power purposes — and their adaptability and ruggedness makes them useful for many industrial purposes.

WRITE FOR BULLETIN 731

Get complete details on all standard Lindberg Air Cylinder models and sizes with complete tables on bores, pressures, weights, mountings and conversion to low pressure hydraulics.

LINDBERG AIR & HYDRAULIC CYLINDERS

Lindberg Engineering Company, 2441 W. Hubbard Street
Chicago 12, Illinois

Rubber Hose Clamps . . . A comprehensive Bulletin No. 125, on a complete line of hose clamps for every industrial rubber hose application, has been issued by the Hose Accessories Co. Well illustrated, the bulletin contains complete information on all types and sizes of these clamps, their capacities and application details. This booklet should be a useful reference for the user of industrial rubber hose.

Circle 219 on Reader Service Card

Air Velocity Meter . . . Bulletin 809 issued by the Bacharach Industrial Instrument Company, outlines the features and applications of the air velocity meter, which has been designed to meet the need for a convenient, rugged and accurate air flow meter of moderate initial cost. The instrument has a wide range of industrial and laboratory applications, for measurement of velocities in air conveyor pipes and ducts, velocity of cooling air through generators, motors and electronic machinery. The instrument gives accurate velocity readings directly in feet per minute or mile per hour and requires no stop watch, charts or mathematical calculations. Several applications and attachments are illustrated.

Circle 220 on Reader Service Card

Hydraulic Equipment . . . Donnell Hydraulics Company has published an eight page booklet, featuring an electrically driven hydraulic pump, which is part of an efficient self contained power package; a hand pump available in three pressure sizes which will handle pressures from 100 psi to 5000 psi; high and low pressure rams and various types of valves. The book is illustrated and all performance data and specifications are given.

Circle 221 on Reader Service Card

Centrifugal Pumps . . . Ingersoll Rand has issued a 16 page bulletin covering general purpose centrifugal pumps of the cradle mounted type. Described are five basic cradle groups and 17 corrsponding pump types, their capacities, horsepower ratings and uses. There are also two pages of pump dimensions and a table of performance. Special purpose units and design modifications are listed. The company also published a 36-page pocket size booklet entitled "Our Latchstring Is Out", presenting a brief history of the company, its plants and products, giving little known facts about the organization. There are nearly 100 pictures showing the company's products at work.

Circle 222 on Reader Service Card

MOTOR DRIVES . . . Allspeed motor drives of from ⅓ to 7½ horsepower are described in a 16 page bulletin published by Worthington Corporation. Described and pictured are both upright and horizontal drives of either closed or skeleton types. Sixteen pictures graphically portray the ease of belt change. Discussed are such problems as service, electric motors, torque, bases, adverse operating conditions, shaft variations and mounting. Two pages of selection tables, one page describing how to select proper drive, and one page each on operation and maintenance are included. Dimensions and line drawings on the various drives are also featured.

Circle 223 on Reader Service Card

AIR VALVES . . . If you are applying air power to machine tools, special machinery or processing equipment, you'll find the new "Valvair Diversatility" bulletin, prepared by Valvair Corporation to be a valuable reference. Drawings in the 8 page bulletin show 9 control assemblies using 3 basic body designs in 5 types and 5 sizes. Cross-section of the 5 basic types clearly illustrate the construction and operation of these valves. Typical application pictures and circuit drawings are included.

Circle 224 on Reader Service Card

Circle 67 on Reader Service Card

DURABLE . . . COMPACT . . .

Pathon

HYDRAULIC CYLINDERS

RH series for 2000 P.S.I.

On all applications Pathon RH series cylinders offer you a "Plus Factor" . . . greater fatigue life . . . lower maintenance costs . . . extra capacity for shock loading. Write us today for full information.

HYDRAULIC CYLINDERS—VALVES

Pathon MANUFACTURING COMPANY

Pacific Avenue Cincinnati 1, Ohio

The only COMPLETE Line

Patented and patents pending

Just a "Twist-of-the-wrist" to connect under pressure.

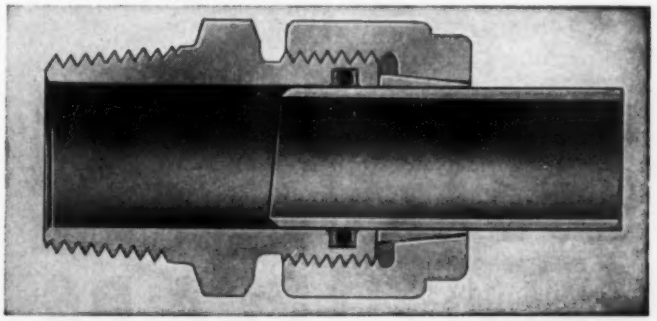
ULRIX QUICK COUPLERS For All Hydraulic Lines!

A model and size for any problem! Standard and Break-A-Way types . . . connect under pressure without tools.

WRITE FOR FULL DETAILS

ULRICH MFG. CO. ROANOKE, ILL.

LENZ "O-RING" TUBE COUPLINGS



Eliminate Flaring . . . Threading Welding . . . Soldering

- Seal and grip are separate
- No metal to metal seal
- No exact tube length necessary
- Not necessary to cut tube square
- No concentration of stresses due to flares or ferrules for tube failures.
- Fast Installation — No tools required but a wrench.

For complete details & Specifications write for bulletin AH 101

LENZ COMPANY

Box 1044-A • Dayton 1, Ohio • Melrose 2557 - Michigan 7985

Circle 116 on Reader Service Card

Circle 128 on Reader Service Card

We weren't that good ...and we knew it

Five years ago we tried to diagnose our business position. Oberdorfer, mostly under the direction of the family of the present ownership, had been a continuous financial success as a foundry since 1876, and as a mass maker of small pumps since 1897.

The pump division had a record of continuously increasing sales and *no important competition*. Yet something was wrong, because we knew our pumps couldn't be that good. We might be able to go on fooling all of the people for a while longer, but we'd better wake up before they did! We just weren't that good! We realized that what we needed – and quickly – was a dose of sound preventive medicine.

Business doctors were available. So were engineers, technicians, economists, financial wizards and crackpots – all at a price. Our decision was to scrap this group and simply use all the brains God had passed out to us.

We weren't brilliant, so it took a long time. But five years later we have married a unique type of quality production to an unusual kind of service to produce a very interesting line of pumps at a very interesting cost. Early in 1953, the offspring of that marriage will first be placed on the market in substantial quantities.

We know now that we possess the formula for a new business medicine as effective as the antibiotics when compared with our former cathartic cureall. Many times longer-lived, all-bronze Oberdorfer Pumps, with interchangeable parts machined to a fraction of a thousandth of an inch, will soon be available throughout the free-trading world at a very low price.

OBERDORFER BRONZE PUMPS

Industrial Pump Div.
Oberdorfer Foundries, Inc.
5211 Thompson Rd.
Syracuse, New York

Please send a preview of the corrosion-resistant all-bronze Oberdorfer pumps to be available in 1953.

Name_____

Company_____

Address_____

Electric Motors . . . Bulletin A 2703 is a new 4-page quick reference bulletin, describing and illustrating principal products manufactured by the Reliance Electric and Engineering Co. The booklet outlines precision built A-C motors from ¾ to 300 hp, heavy duty type T D-C motors from ¾ to 1000 hp, electronic controls and regulators. Many functions and advantages of the products are listed. Service applications for which they are designed are indicated and representative units illustrated. The booklet should be a useful addition for machinery designers, plant electricians and those interested in motors and in-plant power transmission equipment.

Circle 225 on Reader Service Card

Hydraulic and Pneumatic Valves . . . An attractive 3-color folder describing and illustrating thirteen aviation type valves, has been published by Robertshaw-Fulton Controls Co. Shown are an improved general purpose control valve for hydraulic or pneumatic use, a low pressure aircraft control valve, an on-off magnetic valve that is corrosion resistant to white fuming nitric acid, a high pressure shut-off valve for rocket engines, operated by pneumatic or hydraulic control pressure. Each of the valves covered have complete specifications and flow charts.

Circle 226 on Reader Service Card

Stainless Tubing Steels . . . Two bulletins have been issued by the Tubular Products Division of The Babcock and Wilcox Co. Known as Technical Data Card 143 the bulletin describes Croloy 12 and Croloy 12-2. Included are condensed data on corrosion resistance and mechanical properties. Technical Data Card 144 discusses Croloy 18-8 Ti, for pressure and mechanical uses. There is data on creep strength, mechanical properties, machinability and other characteristics.

Circle 227 on Reader Service Card

Hydraulic and Pneumatic Cylinders . . . Compressed Air Products has prepared a 4-page booklet describing their universal cylinders, series 300. The cylinders are designed to the minimum in size with ample strength, thus permitting their use in restricted spaces. Cylinders are available in both double-acting and single-acting types; double acting types are furnished with any stroke required. Single acting cylinders are regularly furnished for push strokes with internal springs and with strokes to 3". Sectional drawings and dimensions of several models are given.

Circle 228 on Reader Service Card

2-STAGE AIR COMPRESSOR . . . New literature describes the recently introduced gasoline engine driven air compressor unit assemblies built by Brunner Manufacturing Company. The new "D-Al" tank air compressor is designed as a mobile service unit for powering air tools and supplying an air source for road equipment.

Circle 229 on Reader Service Card

LUBRICATION SYSTEM . . . A new 4-page illustrated folder has been published by Trabon Engineering Corp. Pertinent sales points about the application of patented Trabon automatic lubrication systems are covered. The folder includes engineering description of technical methods of operation, in the case of both reversible and manifold types of lubrication systems. This general Bulletin 529 will be useful for anyone interested in the proper planning and engineering of controlled lubrication.

Circle 230 on Reader Service Card

TUBING FOR HYDRAULIC SYSTEMS . . . Superior Tube Company offers a chart sheet giving recommended maximum working pressures for tubing diameters from ⅛ to 1⅛ inch O.D. Data on sizes, temper and chemical analysis is included.

Circle 231 on Reader Service Card

Circle 48 on Reader Service Card

MAINTENANCE MEN!

GET THE FULL STORY ON HANNIFIN'S

NEW Pilot-Master Air Control Valves!

Fewer Valves to Stock. Same valve operates either 2-way or 3-way, normally open or normally closed. 4-way valves also available. Pilot valves for remote control.

Fewer Parts to Stock. Every moving part of main or "master" valve fits in an easily removable cartridge. NO SPRINGS! Two sizes of cartridge fit all 5 valve sizes. Pilot heads (solenoid or pressure operated) fit any size valve.

Solenoids Easily Serviced. The specially designed solenoids can be disassembled to replace the coil, or to install a coil of another voltage.

All Sizes From ¼" to 1¼" I.P.S.
Pressures From 15 to 150 P.S.I.
Write for Bulletin 231 and get the complete story!

HANNIFIN

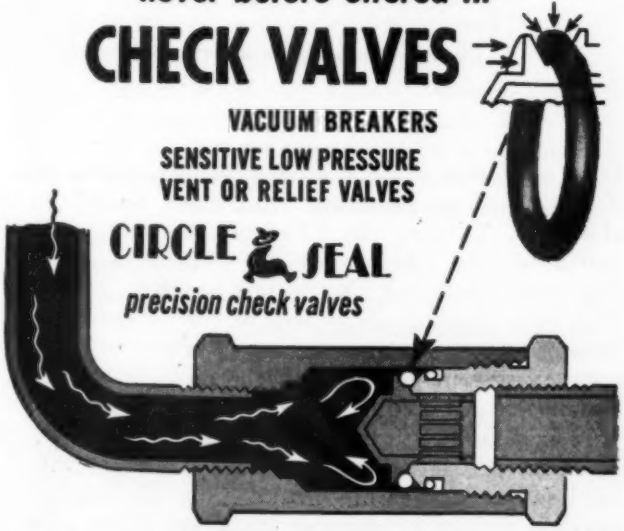
Hannifin Corporation • 1155 S. Kilbourn Ave. • Chicago 24, Ill.

the circle seal principle

provides sealing assurance never before offered in

CHECK VALVES

VACUUM BREAKERS
SENSITIVE LOW PRESSURE
VENT OR RELIEF VALVES



JAMES-POND-CLARK

1247 East Green Street, Pasadena 1, Calif.

Engineering data sent free of charge on request.

Circle 59 on Reader Service Card

NEW SKINNER SOLENOID VALVE

EXPLOSION PROOF TYPE X5

THE new Skinner X5 Solenoid Valve is basically the same as the widely accepted and tested V5, but modified to a construction that is Underwriters' approved for Class I, Group D hazardous locations. Small size and lightweight features are retained, and the X5 is low in price because of the many parts which are interchangeable with other Skinner valves. Rating is 10 watts max.; soft, spring loaded seals prevent leakage; internal parts are stainless steel; wide variety of port locations in ⅛" and ¼" size; most types available for metering; for AC or DC in a wide range of voltages and frequencies; can be mounted in any position; supplied as two-way normally open or closed, three-way normally open, closed or directional flow. *Write today for details!*

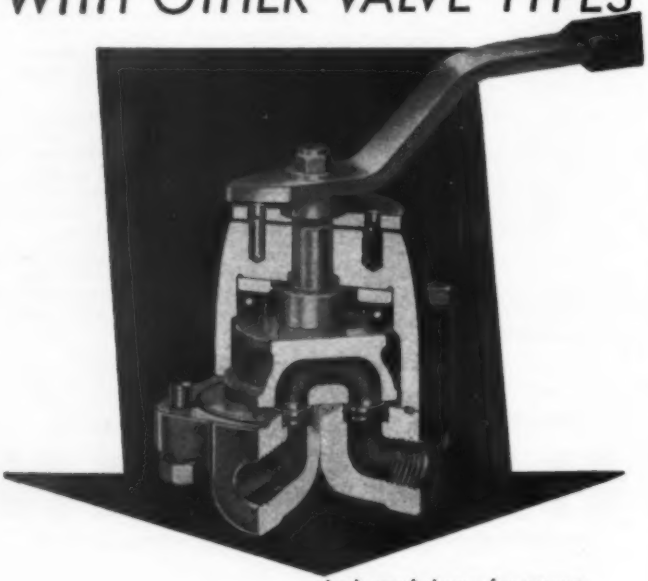
SKINNER ELECTRIC VALVE DIV.

THE SKINNER CHUCK COMPANY

142 Belden Ave., Norwalk, Conn.

Circle 103 on Reader Service Card

COMPARE Shear-Seal CHARACTERISTICS WITH OTHER VALVE TYPES



1. LEAK PROOF	Leak proof closure for vacuum to 6000 psi water, hydraulic oil, and air is accomplished by pressure loaded self aligning 'Shear-Seal's' mating with optically flat slide or rotor.
2. LOW HANDLE LOAD	Easy non-fatiguing operation at 6000 psi due to generous ball bearings and pressure balanced sealing members.
3. HIGH FLOW CAPACITY	Large, smooth, tubular flow passages.
4. NO PRESSURE WASTE	Flow passages are unobstructed by poppets or spools.
5. NO WIRE-DRAWING	Flow is through the hole in the center of the 'Shear-Seal', never across sealing surfaces.
6. EXCELLENT THROTTLING	The smooth valve operation permits infinite throttling.
7. COMPACT SIZE	Barksdale Valves have none of the bulkiness usually associated with high pressure valves.
8. NOT CRITICAL TO DIRT	The square corner wiping action between 'Shear-Seal' and rotor keeps dirt and pipe scale away from sealing surfaces.
9. LONG SERVICE LIFE	Under the continued lapping action of the metal to metal seals "Barksdale Valves wear-in where others wear-out."
10. LOW MAINTENANCE	No lubrication required — no freeze ups even where valve is seldom operated.

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Control Valves . . . "New Techniques in Control Valve Design" is the title of a new 16-page technical bulletin issued by Conoflow Corporation. The bulletin covers a complete review of the development of our present day conventional control valves and a look-see into the future designs of tomorrow. The bulletin is well illustrated and fully explains the underlying reasons for today's designs and the logic behind the predicted designs for the future.

Circle 232 on Reader Service Card

Remote Pressure Control . . . The hydrotorque control system, an instrument of positioning control, is described in a 12 page Bulletin 157, published by the Farris Hydrotorque Corporation. Combination of hydrotorque transmitters and receivers are possible. Two transmitters may well be operating one receiver, or one transmitter may operate two receivers or a multiplicity of receivers. This system, operating pilot needle valves, will do a wide scope function where very large forces and loads beyond the hydraulic system itself can readily be handled. The catalog is well illustrated, and includes dimensions, specifications and installation pointers.

Circle 233 on Reader Service Card

Air Compressor . . . Pennsylvania Pump and Compressor Company have released a 4-page bulletin, describing the advanced design of straight line single stage heavy duty Class 3-ATCL air compressor. The compressor, thoroughly tested in service and accepted by industries where critical demands for absolutely oil-free compressed air or gas must be met, performs with minimum maintenance. A sectional illustration details the construction of the 9" stroke compressor.

Circle 234 on Reader Service Card

Oil Lubricator . . . A 4-page booklet featuring the Micro-Fog lubricator has been issued by the C. A. Norgren Co. The booklet describes in full detail the advantages and improvements of this new lubricator, the design of which is such that approximately 5 percent of the oil flow seen through the sight feed glass is converted into a true fog and carried into the air stream. The possibility of oil collecting in the lines is reduced to a minimum. Eight models are now available, ¼" and ⅜" size. Both sizes are available with oil bowl capacities of ⅓ and ½ pt. Normal operating ranges in various steps are from 1cfm at 10 psi to 14 cfm at 80 psi. Maximum safe operating pressure is 125 psi.

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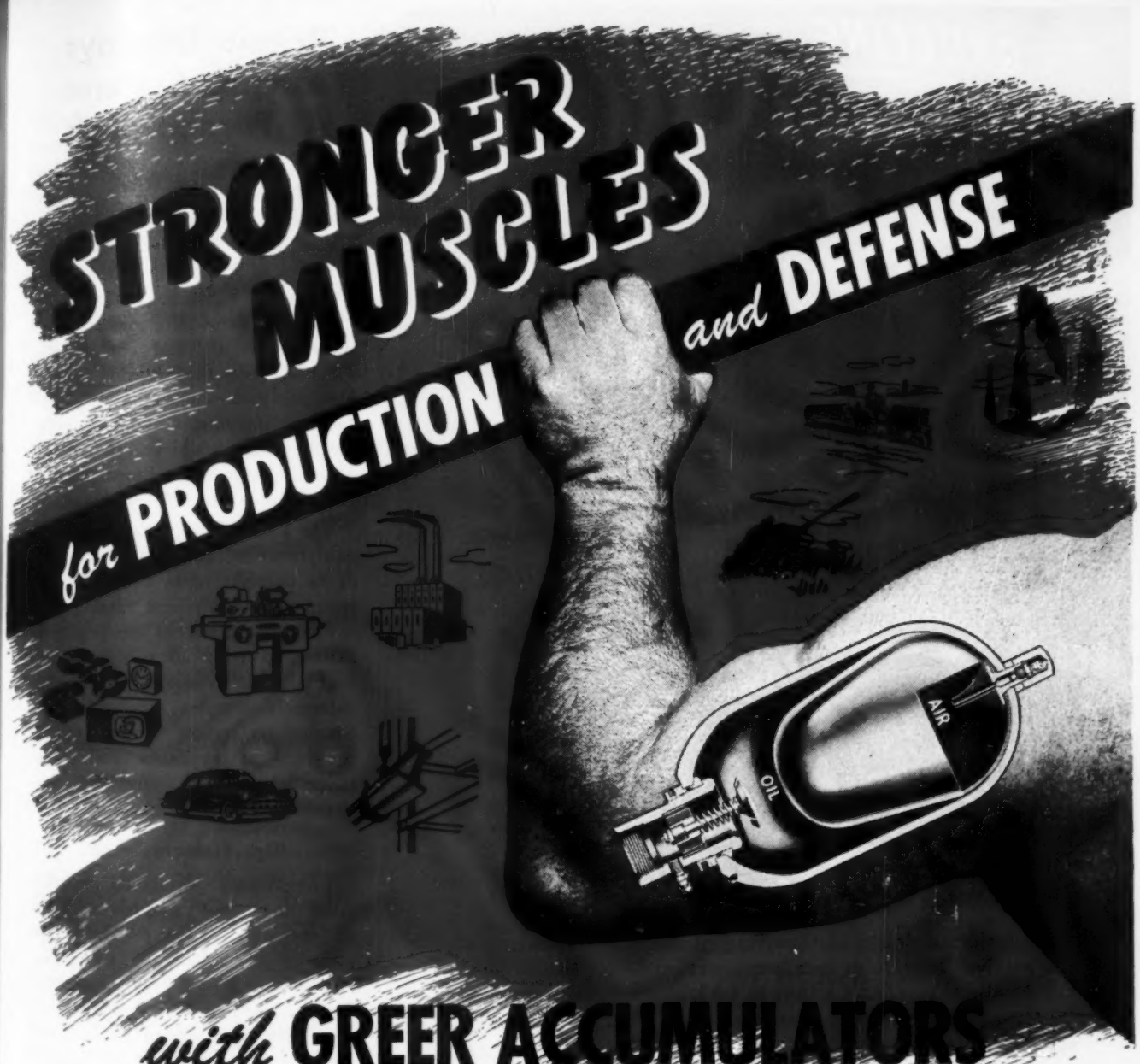

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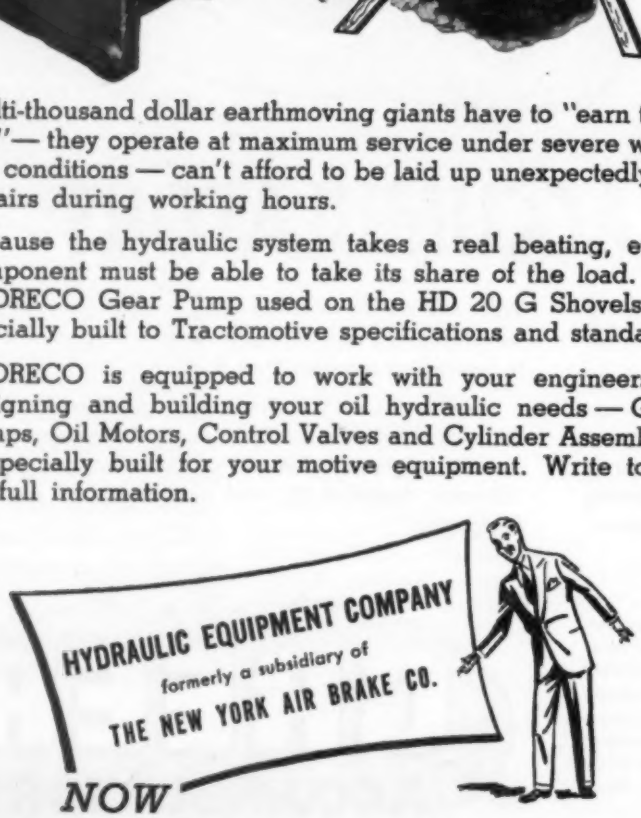
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Britain Displays Aircraft Systems At Farnborough

THE 1952 S.B.A.C. Air Display at Farnborough in September attracted more than 15,000 overseas guests from 70 countries. Large numbers of American visitors, both civilian and U.S.A.F. personnel saw the flying demonstrations and inspected aircraft and components. The show was the occasion for the first public demonstration of supersonic flying and also, unhappily, for the disaster which cost the lives of John Derry, a leading test pilot, his observer and 29 spectators.

The Exhibition of manufacturers' equipment included many examples of the part played by hydraulic and pneumatic equipment makers in overcoming many of the problems associated with ultra high speed, high altitude aviation. The modern, extremely complex airplane, is dependent on remote control systems provided by hydraulic and pneumatic means, for many of its astonishing performances.

High Pressure Trend

Components displayed emphasized the current trend toward higher pressures: 4000 psi hydraulic systems and 3000 psi pneumatic systems are now generally accepted for compactness and weight economy. The majority of modern aircraft are equipped with power-assist or power-operated controls and numerous such systems were displayed.

Such controls, generally, fall into two groups: one using direct acting cylinders to provide power assistance without detracting greatly from the "feel" of the pilot's control column; the other using irreversible mechanisms which can be described as power-operated, in which there is no mechanical connection between the control column and the control surfaces of the aircraft. The former are more in favor than the latter in Britain. Such firms as Automotive Products, Ltd. and the Fairey Aviation Co., Ltd., offer boosted controls now fitted to current aircraft. This type of system was discussed recently in this magazine in a three part article on Power Flying Controls (August, 1952, pp

72-74; September, 1952, pp 86-89; October, 1952, pp 54-56).

A more recent English development is the power-operated control system. One exhibited assembly comprised an electric motor, direct-coupled to a fixed delivery piston pump which feeds pressure oil to a directional control valve linked to the pilot's column. Oil from this valve flows to a hydraulic motor whose rotary motion is transformed into linear travel for operating the control surfaces by means of a screw-jack.

To provide the necessary feel a "feel-simulator", a pitot tube piped to a pressure regulating valve, is connected to a small feel-cylinder linked to the pilot's "stick". At low air speeds the pressure on the feel-cylinder is negligible; as air speed increases the pressure progressively opens the regulating valve, admitting higher oil pressure to the feel-cylinder, stiffening up the movement of the stick.

Landing Gear Development

The wide use of the gas turbine has influenced the design of landing gear. The smaller diameter of this type of power unit, as compared with the piston engine, has neccessitated the reduction of landing wheel size to enable the retracted wheels to be completely "buried" within the engine nacelle or wing. This has led to the bogie type of undercarriage which has given a better weight distribution on runways, particularly for heavy aircraft.

A well known aircraft pneumatic manufacturer displayed a series of valves for the utilization of air bled from the compressor of a jet engine. Air bleeding is also used to supercharge the latest 3000 psi air compressors, overcoming the falling-off of compressor performance at high altitudes.

Avica Equipment, Ltd., displayed an all metal flexible hose for high temperature applications in jet engines where rubber flexible hoses would not be suitable. This hose is built up on a stainless steel interior of convoluted form, surrounded by a conventional braided sheath of stainless steel wire. The end couplings are attached mechanically and may be of light alloy, mild steel or stainless.

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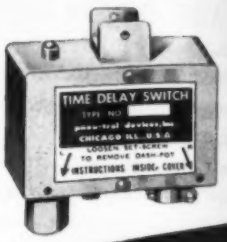
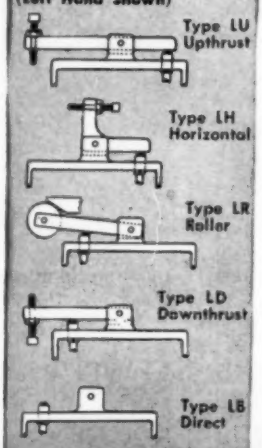


For Any Type Actuation Left or Right Hand (Left Hand Shown)



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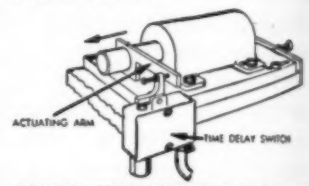

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36 to 1 G.E. (306 shaft RPM)
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A Basic Approach To Design Problems

Continued from page 75

ment should be selected and installed so that in case of failure it can be readily serviced. Providing accessibility requires orderly design with ample space for valves, fittings and wrench clearance. This consideration should definitely influence the selection of equipment.

8. Safety

Is it advisable to provide a "dead-man" safety? What happens if the operator bumps the control? Should a quick shut-down or stop by provided? What if power should fail? Will the operator, costly work, or the machine be in danger if machine is restarted after power failure? Should a normal "safe" position be incorporated in valves, controls or cylinders? Are counter-balances necessary? Will hydraulic leakage or failure of any connections be hazardous as in hot areas in permanent mold shops?

Any early opinions regarding the design or choice of air or hydraulic components may have to be changed considerably to meet advisable safety requirements.

9. Relation to other functions

The importance of and relation to other machines in the production line requires proper consideration. Decision as to design or selection should be conditioned by:

1. Necessary interlocks
2. Interchangeability of parts and components
3. Stand-by equipment

If a production line is dependent upon the continuous and efficient operation of the unit being designed it might be advisable to figure a duplicate power source and in some unusual cases a duplicate control mechanism. A ship steering mechanism may be cited as a good case for duplication of the complete power source and control system.

10. Cooperation of the User

Whether you are designing for a customer or for use in your company's plant, the attitude of the people who must accept the design is important. On an unusual job your design and the equipment you select may depend on whether this attitude is "Sounds good, Let's try it" or "Guarantee it."

11. Cost—Availability—Life Expectancy—Appearance

These factors for the most part are self-explanatory. The budget can limit or completely revise your design ideas; likewise you won't try to include equipment that won't be available until after the need has passed.

If the useful life of the installation is to be brief you may decide to live with some difficulties and inefficiencies which would not be acceptable otherwise.

12. Second Guessing

Any honest appraisal of all factors influencing design must recognize the value of second guessing. It

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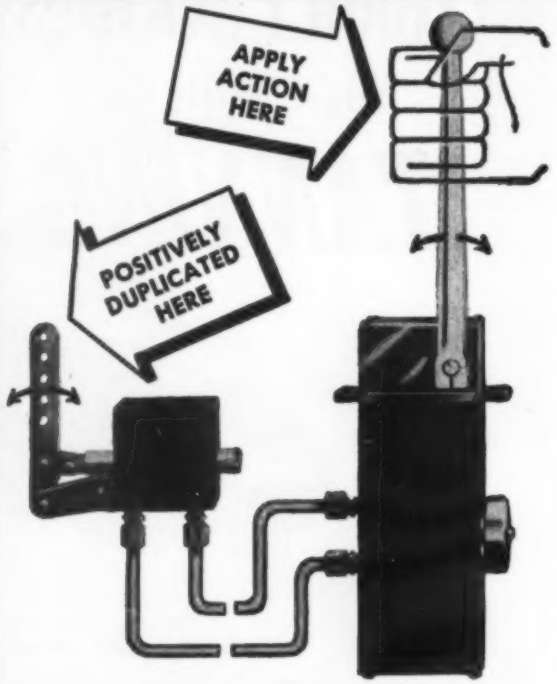

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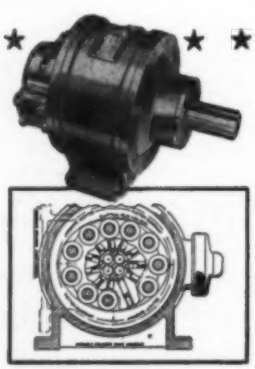

Superdraulic CORPORATION

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is a valuable aid to review the thinking of some one else and observe results to pick up details that were missed or not perfected in the first unit.

Another condition which must be recognized for its importance and variable characteristic is the personal factor, ie., background, judgment and imagination of the designer.

In conclusion we can't resist the temptation to say that if you check the weather bureau, the streets, traffic and fire departments and the Chamber of Commerce before you drive across town (from A to B) either we or you missed the point.

Flexible Hose Assemblies For Air Systems

Continued from page 81

inate wasted air through leakage. Also pressure gauges subjected to rapid pressure build-up and shock, as to test rigs, should be checked for accuracy from time to time against a master gauge.

Storing

When not in use, flexible hose and lines of all types using rubber construction should be stored in the dark, at a temperature in the region of 60 F. and in a completely unstressed condition. These factors are important, as exposure to heat, sunlight, ozone in the atmosphere and conditions of stress accelerate the normal slow oxidization process of the rubber.

For units to be used at high pressures and in store for long periods, it has been found advisable to recommend an inspection and pressure test every twelve months. This pressure test has been set at the pressure at which the assemblies are to be used and not, as in the case of their production test at one and a half times the rated working pressure of the hose.

Such a test, carried out under water, will show up any deterioration or leaks which may occur at the junction of hose and coupling owing to permanent set of the rubber over a period of time. The volume of rubber compressed within the usual end coupling is relatively small, and under the searching effect of high pressure air, any relaxation of this compression, or cold flow of the rubber, will show up as a leak. It is frequently possible with factory assembled units to reclaim such leaky hose assemblies by carrying out a reswaging operation, reducing the outer coupling ferrule diameter slightly under the normal manufacturing dimension, thus compensating for the initial loss of compression of the rubber.

Experience has shown that little special consideration is needed for low pressure lines, whereas manufacturer and user alike are well advised to exercise extra caution when dealing with high pressure air. As a result of increased reliability there is an increasing demand for air line assemblies for all types of industrial applications.

Design and Application of Flared Fittings

Concluded from page 77

and burr to remove only the sharp edges. Bend if necessary. Place the nuts and sleeves on the tubing and flare to the proper angle and size. See chart, Figure 6. To assemble in position, run up the nut as far as possible by hand, then with wrench until it begins to be snug apply 1/8 to 1/6 turn.

The Triple 811 fitting has been widely used in all kinds of industrial applications. It is usually made from carbon steel, but has been made in brass, aluminum and stainless steel as well. It gives very good pressure holding and vibration performance. Care must be taken to keep the flare within size so that threads are not stripped in assembly. See Figure 6. The fitting can be used with any kind of tubing.

The manufacture of the AC 811 tube fitting has been discontinued. It has been superceded by the new Triple-Lok design which will be described later.

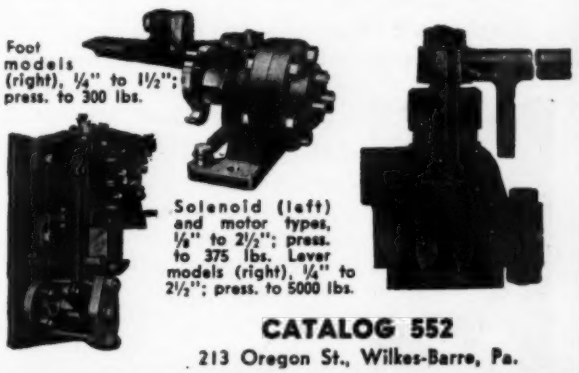
Other standard types of flared fittings will be discussed next month.

Circle 81 on Reader Service Card

LARGE PROCESSOR CHOOSES

Nicholson Valves for LONG WEAR

Nicholson cylinder control valves recently completed 10 years of constant use, without servicing, on an operation which had proved too much for other tested units. This report, from a large rubber firm, again confirms the fact that Nicholson valves, with their specially treated hard seats and non-corrosive lapping flat discs, become tighter with use. Nicholson furnishes valves for cylinder control, distributing and metering service, and for many special operating cycles. For air, gas, oil, steam, water.



Foot models (right), ¼" to 1½"; press. to 300 lbs.

Solenoid (left) and motor types, ⅛" to 2½"; press. to 375 lbs. Lever models (right), ¼" to 2½"; press. to 5000 lbs.

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TEMPERATURE CONTROL

Keep oil temperature constant with this compact, self-contained, completely automatic, low-cost unit installed in your heat exchange system. Eliminate the human element at the cooling valve. Remember, oil too hot means slippage . . . too cold means sluggish operation and wasted cooling water.

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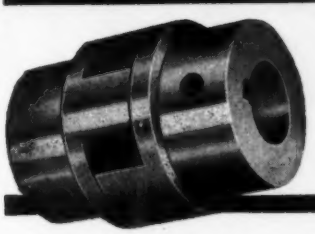

GERBING'S *Exclusive* CONCAVE JAW SURFACE

The concave jaw surface of the new Gerbing Flexible Coupling actually holds the resilient synthetic rubber insert or spider in position, thus eliminating any tendency of the rubber to break or extrude. Capable of handling peak loads, shocks and overloads. Instantly compensates for angular and parallel misalignment.

Available for shafts ½" to 1⅞" and H.P. ranges from fractional to 25. Standard keyways are provided. A long-lasting vibration-free drive for a wide range of applications. Deliveries from stock.

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. . . holds spider in position at all times —No extruding!

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APPLIED HYDRAULICS

Post Scripts of Industry

News about people, manufacturers and sales organizations

Blackhawk Manufacturing Co., has announced the appointment of **Robert C. Wacker** as general manager of the company's recently created hydraulic control division. Wacker joined the company in 1939 and was formerly manager of the equipment division. The new division is responsible for the design, manufacture and sale of hydraulic equipment for use by concerns who incorporate hydraulics into the manufacture of their own products.

R. C. Wacker

The eastern district office of **The Hydraulic Press Mfg. Company** is now located at 352 Cedar Lane, Peoples Trust Company Building, Teaneck, New Jersey. The office was formerly located in New York City. Continuing in charge of the office is regional manager, **C. J. Ziegfeld,** and **T. G. Bishop,** sales engineer.

The Denison Engineering Company of Columbus has just opened a branch office at 565 North Prairie St., Hawthorne, California as headquarters of the company's west coast sales and service operations. Serving as manager of the branch will be **William D. Peters,** who has had broad experience in the engineering, design and development of hydraulic equipment. He has been with Denison Engineering Company since 1941. Assisting him as sales engineer, will be **Victor P. Preidis** who for the past several years has represented Denison in a sales capacity in the heavily industrialized sections of the country.

At a meeting of **Brunner Manufacturing Company** executives, the appointment of **A. L. Haldeman** as Brunner district manager in the Cleveland territory was announced. Haldeman succeeds Steve Hanna who has been with the Brunner organization for the past sixteen years and is retiring this month. Eddie Briggs, Brunner representative in Pittsburgh area, and W. Wassmandorf, representative in Michigan, will continue with the company and work directly under Haldeman.

A. L. Haldeman

George N. Landis has been appointed chief electrical engineer of the newly created electrical department of **Hydropress, Inc.,** New York, and its Loewy Rolling Mill Division. Mr. Landis has been connected with the organization since 1942.

The appointment of **Herbert F. Ziegler, Jr.** as manager of the Kansas City, Missouri district office of **Sterling Electric Motors, Inc.** has been announced. Also announced was the appointment of the following additional distributors. Cascade Industrial Supply, Inc., 515 Market Street, Klamath Falls, Oregon; Selma Foundry and Machine Co., P.O. Box 662, Selma, Alabama; W. S. Wilson Corp., 11 So. William St., New York 4, N. Y.; Roger Brown Co., 111 E. Missouri, El Paso, Texas; Herr Electric Co., 410 W. Conway St., Baltimore 30, Maryland; Story Electric Repair Co., 269 Paterson Avenue, Little Falls, N. J.; Woodbury & Co., 133 S.W. 2nd Avenue, Portland, Oregon.

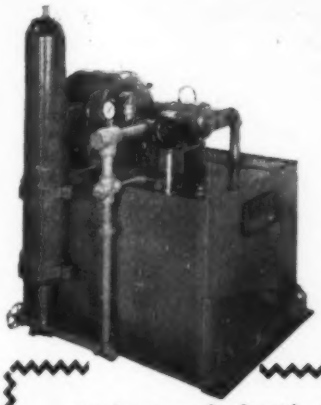
The promotion of **Whiting N. Shepard** to director of sales of the Boston Woven Hose and Rubber Company was announced. The appointment of Shepard is part of the company's expanded marketing program, necessitated by increasing diversification of the company's products. Until his promotion he was head of plastics sales for the Boston company.

W. N. Shepard

Control Engineering Corporation of Norwood, Mass., announced the addition of **William D. MacGaregill** to its sales staff who will assist in the promotion of the new line of precision instruments and associated equipment.

Circle 56 on Reader Service Card

Standard Power Unit . . .



for Furnishing Hydraulic Power to Payoff Reel in Processing Lines

Combination of solenoid controlled relief valve, pressure switch and accumulator maintains constant pressure to keep coil drum expanded and also unloads pump whenever only holding pressure is required.

Unit has sufficient capacity to power all cylinders for coil hoist, traverse, drum expander, shifter for edge alignment. Large reservoir and automatic unloading of pump eliminate need for water cooling coils or heat exchangers.

Your inquiries for custom designed and standard power units will receive immediate attention.

Standard reservoirs in capacities 40, 60, 80, 100, 200, 300, 400, and 600 gallons.

"HYPECO"

HYDRAULIC POWER EQUIPMENT CO.

Custom & Standard Hydraulic Power Units

BOX 431 NORTH LIMA, OHIO PHONE 9-3717

Youngstown Suburb

MONOPAK METALLIC PACKING

Prolongs the Life of Hydraulic Cylinders

Seals against Oil, Water, Brine, Air, Gases and Refrigerants

ASSURES UNEXCELLED DURABILITY

Burst-proof, does not blow out . . . Compact and easy to install . . . Low Friction insures long life. Now adopted by hundreds of manufacturers and users of machine tools.

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HYDRAULIC ACCESSORIES CO.

439 E. Fort St. • Detroit 26, Mich.

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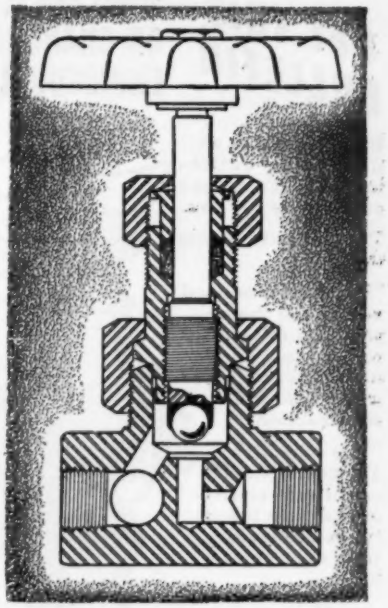
NEW!

BALL VALVE

for liquids, gas or steam



Here's a radically-new forged steel valve for general heavy industrial use. Can't leak . . . practically never wears out . . . costs little or no more than ordinary valves!

In place of a disc or plug, the new Foxboro Ball Valve has a retained, free-rolling stainless steel ball that exposes new surface to seat at every closing.

Foxboro Ball Valves handle pressures to 3000 psi. Available in straight-thru and angle types. Two or four connections to simplify piping. ¼" size. Write for detailed folder. **The Foxboro Company, 2111 Neponset Avenue, Foxboro-Mass., U.S.A.**

FOXBORO INSTRUMENTATION

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REPUBLIC VALVES

INDUSTRIAL • CHEMICAL • AIRCRAFT

J.I.C. AND AN STANDARD TUBE ENDS

Skilfully engineered 2, 3, and 4-way Plug Valves are built by Republic in brass and aluminum alloy, sizes ⅛" to 1". Hydraulic Relief Valves opening at pressures up to 450 psi made in brass, aluminum alloy, steel, and stainless steel, sizes ⅛" to ¾". Pipe, AN or J.I.C. tube ends, or combinations.

4-WAY PLUG VALVE, WITH DRAIN

Also manufacturers of high quality globe, needle, low and hy-pressure check valves, and special valves to specifications.

Write for complete catalog and name of nearest distributor.

83

REMCO

REPUBLIC MANUFACTURING CO.

1930 WEST 77TH STREET • CLEVELAND 2, OHIO

Circle 33 on Reader Service Card

GET THIS BULLETIN

WHETHER IT'S ORIGINAL EQUIPMENT DESIGN OR CHANGING OVER TO AIR, YOU MAY SAVE ENORMOUSLY BY STANDARDIZING ON . . .

VALVAIRS

Thanks to Diversatility

★ ★ ★

ESPECIALLY ADAPTED TO TOOLING AND FIXTURE DESIGN

★ ★ ★

Eight pages, well illustrated, outlining Valvair's unique advantages *for you.*

The bulletin starts thus:

"Valvair air control valves are the expression of an original, exclusive, perhaps ingenious idea in design and construction.

"The objective: To meet virtually countless requirements with fewer types of valves than ever before," etc.

Your letterhead request will be answered promptly.

3-way, knob-operated air control valve.

• Valvair Diversatility is an exclusive, original form of standardization. Five basic bodies permit incorporating any one (or two) control assemblies with a standard valve body. Unique Valvair advantages enable us to speed your order at no extra cost. . . Sizes: ¼" through 1". May we fill your orders *now?*

Get new Bulletin "A-11".

VALVAIR CORPORATION

Affiliate: Sinclair-Collins Valve Co.

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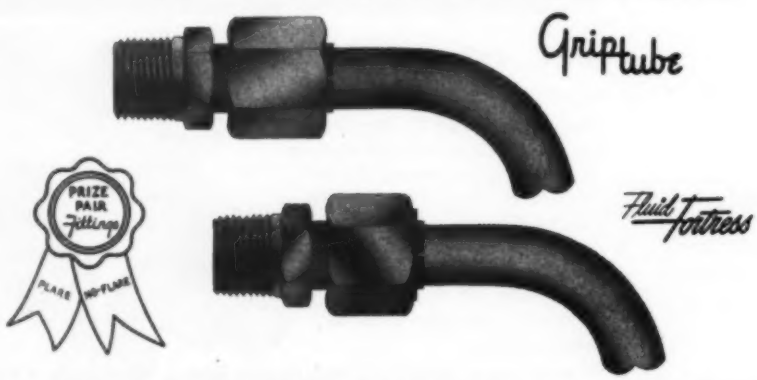
REPRESENTATIVES IN PRINCIPAL CITIES

Rely upon **Valvair**

PRIZE PAIR STANDARD (J.I.C.) TUBE FITTINGS

FEATURING THE ALLOY SPRING STEEL SLEEVE

. . . holds excessive pressures without leakage



FLODAR CORPORATION manufactures two lines of tube fittings.

PRIZE PAIR

(1) GRIPTUBE, a flare type, connector body AN dimensions with improved spring steel sleeve.

(2) FLUID FORTRESS, a no-flare type, eliminates flaring, threading, soldering, welding.

Write for descriptive catalog No. 552

FLODAR CORPORATION

1366 EAST 45TH STREET — CLEVELAND 3, OHIO

King Engineering Corporation, Ann Arbor, Michigan, announces the appointment of **Applied Engineering Company** as representative with offices in three states serving North Carolina, South Carolina, Georgia, Alabama, and Eastern Tennessee. Their main office is at 463 Carolina Ave., Orangeburg, South Carolina, with regional offices at 500 Piedmont Ave., Atlanta, Georgia, and 1605 Elizabeth Ave., Charlotte, North Carolina.

The appointment of **Rexford C. Burnham** as hydraulic division manager of the **J. N. Fauver Company, Inc.,** Detroit, has just been announced. Burnham's experience includes four and a half years with Wright Aeronautical and six years in the press division of French Oil Mill Machinery Company.

R. C. Burnham

Russell V. Mills was appointed field engineer in the East Boston territory by **The Bellows Co.** He was last employed by the Wolk Co. of Waltham, and his new headquarters will be at The Bellows Co., United Building, Boston.

The **Wallace Companies** of **North Carolina,** Bryson City, under the managership of **N. Robert Johnston,** has been appointed a distributor of industrial tube fittings and related accessories manufactured by the Parker Appliance Company, Cleveland.

Control Engineering Corporation, formerly at 863 Washington Street, Canton, Mass., has moved to its new enlarged headquarters 560 Providence Highway in Norwood, Mass.

Micro Metallic Corporation, Glen Cove, New York announces the appointment of **Joseph Whitwell** as engineering sales representative for the California area. His address is 917 East Baseline Road, Claremont, California.

Robert D. Walker was recently appointed to **The Weatherhead Company** staff of industrial sales engineers, and will cover Arkansas, Louisiana, New Mexico, Oklahoma and Texas. Walker has twenty years experience in many phases of hydraulics, gained during his association with drilling contractors in the Texas and South American oil fields. His practical knowledge of on-the-job problems has led him to invent several oil field tools currently in use.

R. D. Walker

George A. Schiller has been named assistant sales manager of the **Dollinger Corporation,** Rochester, N. Y. He was formerly associated with Dustex Corporation.

Appointment of **Donald P. Frankel** as special assistant to Don L. Walter, director of engineering and manufacturing at **Marquardt Aircraft Company,** has been announced. Formerly associated in various engineering capacities, Frankel brings fifteen years of specialization in aircraft power-plant development to the Van Nuys, California ramjet engine research center. Prior to joining the engineering staff at Marquardt, he served as a consulting engineer assigned to headquarters, U. S. Air Force.

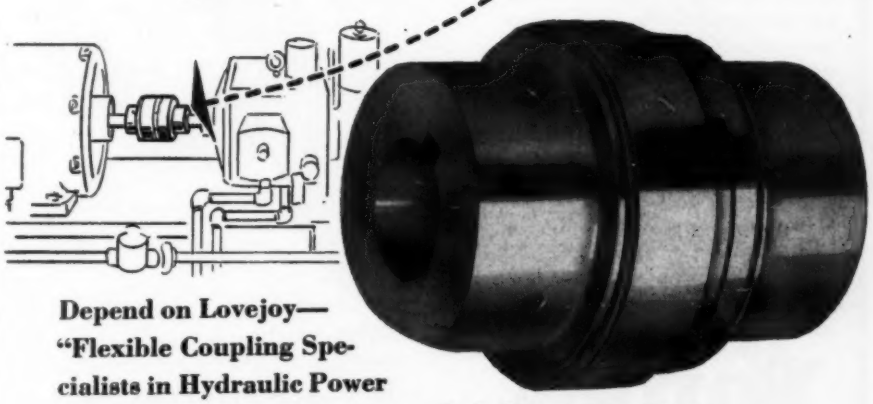
The government sales division and the industrial sales division of the **R. M. Hollingshead Corporation,** have been merged. **Frederick H. Lee, Jr.,** formerly sales manager of the industrial division has been appointed manager for both the government and industrial divisions. **William L. Carolla,** formerly assistant sales manager of the industrial division, has been named sales manager of that division. **John W. Reed, Jr.,** formerly west coast representative for the industrial division, has been named sales manager of the government sales division.

John C. Durbin, Jr. has been appointed a factory sales representative for **New York Belting & Packing Company** in Washington, Oregon and Idaho. Durbin will make his headquarters in Portland, Oregon. For the past several years, he has been associated with the company's San Francisco staff.

A research laboratory has been established to serve all divisions of **Westinghouse Air**

for this vital CONNECTING LINK..... choose...

LOVEJOY FLEXIBLE COUPLINGS



Depend on Lovejoy—"Flexible Coupling Specialists in Hydraulic Power Units"—for the all-important link between motors and pumps. Lovejoy Flexible Couplings automatically correct mis-alignment . . . absorb vibration, surge and backlash . . . feature free-floating load cushions suspended between heavy metal jaws. No shutdowns for changing cushions—no lubrication ever needed. Cushions for every duty . . . 1/6 to 2500 H.P.

Write Now for Illustrated Catalog and Quick-Finding Selector Charts

Also Mfrs. Lovejoy Universal and Lovejoy Variable Speed Transmissions

LOVEJOY FLEXIBLE COUPLING CO.

5037 W. LAKE ST. CHICAGO 44, ILLINOIS

A NEW Lightweight Champion!

SPECIFICATIONS

Characteristics	OLD TYPE	YOUNG A-800
WEIGHT	445 lbs.	230 lbs.
LENGTH	90 in.	49 in.
TUBE DIAM.	⅜ in.	¼ in.
COOLING CAP.	Same	Same
LIST PRICE	$485.00	$370.00

YOUNG A-800 SHELL-AND-TUBE HEAT EXCHANGER OFFERS COMPACTNESS—LOW COST

There is 20% more tube surface per unit volume of space in the new Young A-800 Heat Exchanger. This has been accomplished by better utilization of space within the shell and, as a result, offers new economy in clean water cooling of oil or hydraulic fluids.

Its fixed tube bundle is another space-saving feature. The Young-designed fabricated bonnets assure smooth inlet-outlet flow with minimum impact on headers, and are removable for ease in cleaning and inspection.

Check the complete Young Line before making your next purchase.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

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Heating, Cooling, and Air Conditioning Products for Home and Industry.

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Plants at Racine, Wisconsin and Mattoon, Illinois

DISCOVER FOR YOURSELF NEW HEAT TRANSFER ECONOMY

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Rush me the facts about your ☐ Fixed ☐ Removable Tube Bundle Heat Exchangers, without obligation.

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Brake Company and its subsidiary and affiliated companies including the European companies in the Westinghouse Air Brake group. **Thomas Meloy**, president of Melpar, Inc., Alexandria, Virginia, a subsidiary of Westinghouse Air Brake, has been appointed director of research of the organization and will be chairman of a research and development committee representing the various divisions of the company. The personnel and facilities of Melpar will be utilized by the research laboratory.

William J. Thomas, general sales manager of the tubular products division of **The Babcock and Wilcox Company**, has been named to the board of directors of the division. Thomas has been associated with the company since 1932 and with the division since 1941.

Harlan Knox Perrill, formerly industrial engineer for Hughes Aircraft Company's guided missile plant, has been named manager, engine division Burbank, **Pacific Airmotive Corporation**. Perrill succeeds **L. B. Littrell**, who has been elevated to the position of general manager, aircraft operations.

Manufacturing and selling rights of the Heco Flex-Tip air blow gun have been acquired by the **C. A. Norgren Co.**, pneumatic products manufacturing firm in Englewood, Colorado.

Robert C. Dyrenforth, formerly assistant chief engineer of the Swartwout Company, which he leaves after seven years, has joined the engineering staff of **The Parker Appliance Company**. The Parker Appliance Company has named **J. N. Fauver Company**, 1534 Keystone Avenue, Dayton, Ohio, distributor for their O-rings.

MAKE THIS TEST!

Try

PROMET THE Engineered BRONZE

BRONZE PARTS

We know you'll agree that they're by far the highest quality you've ever used. That's why we can offer a

MONEY-BACK GUARANTEE OF LONGER SERVICE AND LOWER MAINTENANCE COST

Many of America's largest pump manufacturers rely on Promet Bronze thrust plates, bearing plates, pressure plates, connecting rods, bushings and seals.

Machined or rough cast and of the specific formula best suited to the application.

Send blueprints, conditions of operation and other data for recommendations and quotations. Write for free literature today.

THE AMERICAN CRUCIBLE PRODUCTS CO.
1303 Oberlin Avenue
Lorain, Ohio

The appointment of **George J. Fischer** as general sales manager of **Aeroquip Corporation,**

M. J. Betley

G. J. Fischer

Jackson, Michigan, has been announced. Fischer joins Aeroquip after 18 years with the B. F. Goodrich Company. Also announced is the appointment of Matthew J. Betley as works manager who comes to Aeroquip from Electric Spravit Corporation.

E. O. Boshell, president and chairman of the board of **Westinghouse Air Brake Company,** Wilmerding, Pennsylvania, W. C. Buchanon, chairman of the board of Le Roi Company, Milwaukee, Wisconsin, and T. O. Liebscher, president of Le Roi, have announced that Westinghouse Air Brake Company has purchased a majority interest in Le Roi Company.

The Cleveland district sales office of the tubular products division of **The Babcock and Wilcox Company** has moved into larger facilities. The headquarters are located in the National City Bank Building, 629 Euclid Avenue. The Cleveland office services northern Ohio, Erie County in Pennsylvania, and the western part of New York state. **Ray E. Fleeson** is in charge.

Pennsylvania Pump and Compressor Company announced the appointment of Dyke and Tutsch Company to serve as representatives in Milwaukee, Wisconsin. With offices at 3253 North Green Bay Avenue, this sales office will serve Milwaukee and the adjacent area covering 45 counties.

The industrial-aviation division of the **R. M. Hollingshead Corporation,** Camden, N. J. has been re-classified and in the future will be known as the industrial division.

Anthony J. Kreiner is the newly appointed manager of **Pacific Airmotive Corporation's** manufacturing division. **E. L. Black** has been appointed administrative assistant, manufacturing division. For the past seven years Kreiner has been vice president of Designers for Industry, Cleveland, where he directed research and development projects for the aircraft and electronic industries. Black has been active in aviation circles for the past 10 years and was also founder and general manager of the Stanford Research Institute.

John G. Duba, instructor of civil engineering at **Illinois Institute of Technology** and conference secretary of the National Conference on Industrial Hydraulics, has been promoted to the rank of assistant professor at Illinois Tech. Duba joined the faculty of the Institute in 1949.

Airline Outlook Promising

Scheduled airlines in the United States should carry more than 43,000,000 passengers over both domestic and international routes in 1960—an increase of 84 percent over 1951, according to Vice Admiral Emory S. Land, President of Air Transport Association. Admiral Land's forecast, based on a recent survey by ATA, appeared in the current issue of PLANES, official publication of the Aircraft Industries Association.

Land predicts the advent of jet aircraft in overseas operation by late 1957 or early 1958. He forecast that jet airliners would probably take an increasing portion of the steamship market, rising from the present ratio of approximately 35 percent to 70 or 80 percent by 1960.

Jet transports are not expected to exert a strong influence on the domestic rail-air travel market before 1960 since jet transports, in their present stage of development, are not economical for commercial airline operations. However, Land forecasts that improvements in fuel economy and operating dependability should result by 1960 in the availability of jet transports that "can operate, over some routes, as economically per passenger mile (or per ton mile) as present aircraft."

Breaking down his forecast, Land estimates that domestic air carriers alone will transport 41,250,000 passengers in 1960 and that cargo ton miles will rise to 370,585,000 in 1960 as compared with an estimated 237,775,000 in 1952. In the international field, Land expects a total of 4,174,000 passengers in 1960 as compared with an estimated total of 2,333,000 in 1952. In cargo ton miles he foresees a rise over international routes from an estimated 77,673,000 in 1952 to 108,000,000 in 1960.

Service Plane Production Quadrupled

More than 10,000 military planes have been delivered to the nation's air services in the two years since the outbreak of the Korean War, according to an announcement made by Admiral DeWitt C. Ramsey, President of Aircraft Industries Association.

Admiral Ramsey stated that the aircraft industry will reach its production peak in December, 1952, when it will be turning out between 1,000 and 1,100 planes per month for the Services. At present, the overall monthly production rate of military planes has increased more than four times, and production of fighters and bombers for the Air Force has been multiplied by five times since hostilities began in Korea. "Unless work stoppages or materials shortages intervene, aircraft output this year will substantially meet existing schedules," said Admiral Ramsey. These goals call for a production level capable of equipping a 143-wing Air Force and proportionate Navy air arm by the end of fiscal 1955.

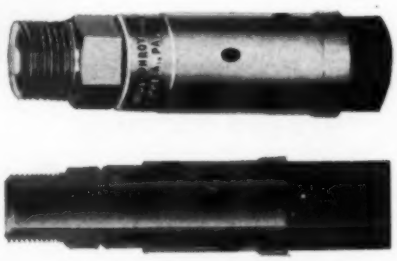
In this two year period 31 percent of the Air Force budget went for new aircraft; 11 percent of the Navy budget was spent on military aircraft and 3/10 of one percent of the Army budget was used for the same purpose. The aggregate of about $7.8 billion or 13 percent of total military expenditures was spent on aircraft.

The Right Combination for All Hydraulic Equipment

MULCONROY Hydraulic HOSE ASSEMBLIES and "PRESS-LOCK" Couplings

With "Press-Lock" Couplings attached, Mulconroy Hose Assemblies provide a new measure of safety, efficiency and economy for all operating or control lines on every type of hydraulic equipment. They are available in three basic hose constructions, to meet any required working pressure; in a full range of sizes and in lengths up to 50 feet. Quickly and easily installed by attaching standard male threaded end of each "Press-Lock" Coupling.

The outstanding success of "Press-Lock" Couplings on Mulconroy Hydraulic Hose Assemblies, in the widest possible range of applications, is evidence of their important contribution to the Hydraulics field.



Cut-away view shows unique construction of the "Press-Lock" Coupling. Note that entire hose wall is utilized—a vital contribution to superior strength and durability.

Three-way gripping efficiency is provided by the "Press-Lock" Coupling, as follows: Inner section of hose wall is pressed into corrugations on stem; outer hose wall, with reinforcing wire, is displaced under pressure into openings in coupling sleeve; sleeve is anchored to collar on stem, back of hex portion. Because the entire hose structure is employed in attaching the "Press-Lock"—no part cut away—hose will withstand shock loads and continuous flexing far beyond the limits attainable by use of conventional type couplings for this service.

Write for Illustrated Catalog

"MULCONROY Starts... WHERE OTHERS Stop!"

MULCONROY CO. Hose Specialties Since 1887

5329 JEFFERSON ST., PHILADELPHIA 31, PA.

More Aircraft Jobs

Plane manufacturers in this country will hire more Americans in the next 17 months than any other industry, according to an announcement in the official publication of Aircraft Industries Association. The present employment figures of 640,000 are expected to rise to approximately 875,000 by January, 1954. By the first quarter of 1954, the industry will have more than tripled its pre-Korean work force, according to the estimate, with aircraft or aircraft equipment being manufactured in at least 33 states.

Major shortages are in engineering, scientific and highly skilled categories. Requirements for all types of engineers, metallurgists, mathematicians, chemists and other professional workers will continue unabated during this buildup period. Among semi-professional workers, most urgently needed are engineering aides, all types of draftsmen and electronic technicians. Skilled workers in greatest demand are jig and fixture builders, tool designers, tool and die makers, machinists, machine tool operators, sheet metal workers and engine and aircraft mechanics.

New "O" Ring Slide Rule Data Chart

To simplify the selection of "O" rings, Plastic and Rubber Products Co., Los Angeles, offers the Parco "O" Ring Selector, covering both 6227 series and 6230 series "O" rings. Pocket size and in accurate slide rule form, it tells at a glance the proper "O" ring to use. All necessary dimensions and tolerances

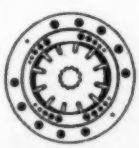
More Stamina
FOR YOUR HYDRAULIC CIRCUITS

"The Finest Money Can Buy!"

DENISON HydrOILics

PUMP/MOTOR

Pump/Motors are made in four sizes, each offering a series of inter-changeable cam rings, providing capacities to meet your specific need.



Complete Radial Balance
Hydraulically balanced vanes reduce load on cam ring, retain low loading characteristics at all pressures. Balanced design assures an extra margin of trouble-free service.

Rugged Space-Saving Design
Compact construction makes Denison Pump/Motors easier to adapt to any circuit plan. Model TMB12, shown above, delivering up to 7.5 gpm at 2000 psi, is only 4⅛" high, 4⅛" wide, and 8" long including the shaft.

Denison's dual-purpose Pump/-Motors combine rugged, compact design with *hydraulic balance*—they *stand up longer* under continuous, heavy-duty use at 2000 psi.

Hydraulically balanced vane and rotor action means smooth, uniform, radially balanced operation. It assures minimum wear on both the vanes and the cam ring, and reduces surge and pulsation to a minimum. For added efficiency, vanes are designed to contact the cam ring with *dual sealing edges.*

Operating at 1200 rpm and 2000 psi, the four Pump/Motor sizes offer pumping capacities from 2.7 to 70 gpm, and motor torque ratings range from 13 to 257 pound-inches per 100 psi. And all models are *ready to operate* as either pumps or motors, without alterations of any kind.

Wherever you need rugged power for circuits developing up to 2000 psi, Denison Pump/-Motors offer *the finest money can buy.* Write for Bulletin P-5.

The DENISON Engineering Co.
1166 Dublin Rd., Columbus 16, Ohio

YOU'LL DO IT BETTER WITH Ledeen CYLINDERS

WHEREVER YOU HAVE TO...

PUSH or PULL
LIFT or LOWER
PRESS or SQUEEZE
TILT or TURN
OPEN or CLOSE

Ledeen cylinders used for air, oil, water, gas or steam operation with medium, heavy or super-duty models, provide a large number of variations and adaptations to meet your specific power or motion requirements. They are available in many diameters and stroke lengths with suitable head and rod attachments to provide almost any desired mounting.
Standard Ledeen cylinders and mountings from distributors' stocks in major cities. Special cylinders if required. All J.I.C.

WRITE FOR BULLETIN 500

VALVES • CYLINDERS
AIR-HYDRAULIC PUMPS & BOOSTERS
VALVE ACTUATORS • AIR HOISTS

Ledeen Mfg. Co.
1610 So. San Pedro
Los Angeles 15, Calif.

for grooves with and without back-up rings are shown on the slide rule.

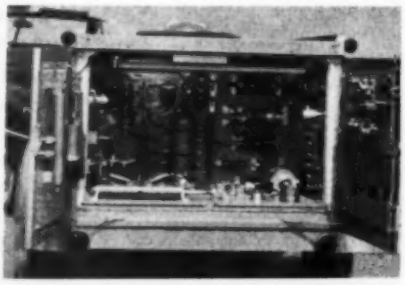
The "O" ring selector is offered free and may be obtained by circling number 250 on the Reader Service Card bound in this issue.

Traveling Exhibit Introduces New Control Unit

MODERNAIR Corporation of San Leandro, Calif., has a travelling exhibit of their lines of cylinders, valves and package units mounted on a trailer truck now on tour visiting dealers in the Middle West. The demonstrator unit, with John E. Goldring, president, in charge, has already visited Chicago, Detroit and Cleveland. Other mid-western cities are on the itinerary during November and December.

Three lines of air cylinders, including a midget series, air control units, air hydraulic cylinders, air valves, a new line of 2000 psi hydraulic cylinders, hydraulic pumping and package power units and a revolutionary new radio active control circuit are all part of the exhibit.

An entirely new safety control device, the Hazatrol Control, is essentially an electric circuit which is actuated by detection of a radio



active material. The radio active material mounted on wrist bands worn by an operator, is of low intensity, well below the recommended AEC tolerance. A Geiger detector tube, protected by a metal case, is mounted in the danger area of a press or other machine. In the demonstrator the tube operates a solenoid valve, controlling an air cylinder, performing an electrical control function without contact. When

Circle 117 on Reader Service Card

MACHINE BUILDERS:
SELL YOUR PRODUCT FASTER WITH VARIABLE SPEED

U.S. VARIDRIVE

U.S. ELECTRICAL MOTORS, Inc.
Box 2058, Los Angeles 54, Cal. or Milford, Conn.

CAPITAL HYDRAULIC OIL FILTER (Sump Type)

Easy To Install and Maintain

Avoid costly breakdowns with the new Capital hydraulic reservoir type oil filter which features a non-corrosive, trap-weave wire cloth, giving clean oil at an extremely low pressure drop. Get full protection—various sizes of filter screens can be interchanged in minutes—can be cleaned without taking apart. Its greater filtering area traps all foreign particles and helps to keep your equipment running at top efficiency.

Capital filters designed to J.I.C. standards are available in filtering capacities of 5, 8, 10, 20, 30, 40, and 50 gals. per minute. Larger capacity sizes can be supplied to meet special requirements. Get bulletin AH-1 for complete details

CAPITAL
ENGINEERING & MFG. CORP.
5837 S. Ashland Ave. Chicago 36 Ill.

the operator reaches one or both hands into the danger area, the detector tube picks up the radio active rays and operates the valve to open or hold open the punch or ram.

System Will "Fail Safe"

The normal range of detection is about one foot. This means that the press or any machine so equipped cannot operate when the operator's hands are within one foot of the detector tube. Since radio active rays penetrate metal, plastics and clothing, their intervention does not materially affect the operating range. A sheet of 16 gauge metal, for example, directly in the path of the rays reduces the range to about 8 inches. Should any part of the detector circuit fail, the machine will "fail safe" and stop with the punch or ram retracted. An additional safety feature is a timer incorporated into the detector circuit. Should the operator not wear wristbands or if the wrist bands are not brought into range within a specified time interval, the machine is rendered inoperative.

THE MARKET PLACE

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8-2829-A	½"	16.17	8.00
10-2829-A	⅝"	21.18	10.50
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DRY-SEAL THREAD
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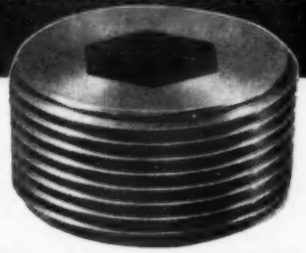

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without compound
.. provide positive sealing even under extreme pressures

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SPS
JENKINTOWN PENNSYLVANIA

Circle 108 on Reader Service Card

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REDUCE DOWNTIME WITH HILCO

HILCO
FILTERS WILL PREVENT SLUDGING, PUMP AND VALVE FAILURES . . .

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Circle 19 on Reader Service Card

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Our units are designed to meet or surpass all "J.I.C." standards.

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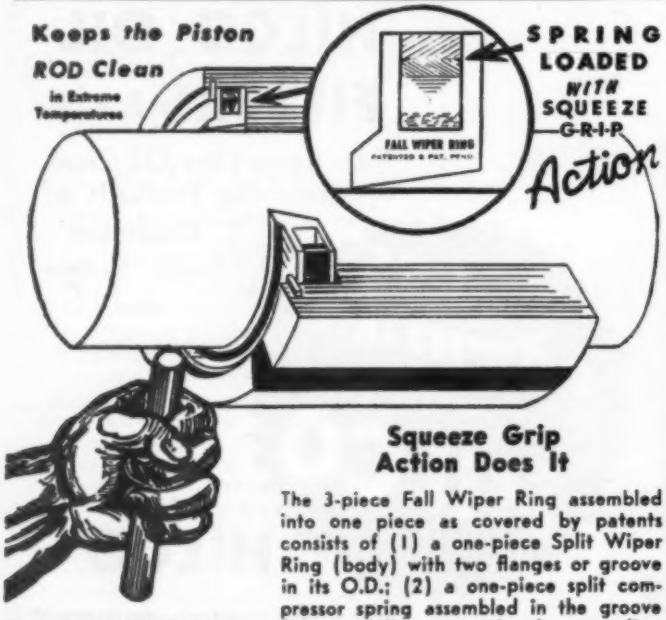
SPRING LOADED WITH SQUEEZE G-R-I-P Action



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The Fall Wiper Ring is available from ½" to 13" dia. Military part numbers from AN6231A1 to AN6231A71. Write, wire or phone us regarding your wiper needs.

Ace Products Company

Toledo 1, Ohio **Phone ADams 6513**

Fall Wiper Ring SPRING LOADED

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Take advantage of Darcoid's complete O-Ring service facilities — immediate delivery from complete stocks!

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Authorized Distributor for The Goshen Rubber Company on all Specification Molded Parts

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Write Gast, stating your specific problem or mention model that interests you.

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Up to 4 H.P. —only 6½" high (less muffler).

Model 4 AM
Up to 1 H.P. —only 5¾" high (less muffler).

Model 1 AM
Up to 1/6 H.P. —only 2½" dia., weighs 1½ lbs.

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Original Equipment Manufacturers for over 25 years

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(TO THREE H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 831 Hinkley St., Benton Harbor, Mich.

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Circle 39 on Reader Service Card

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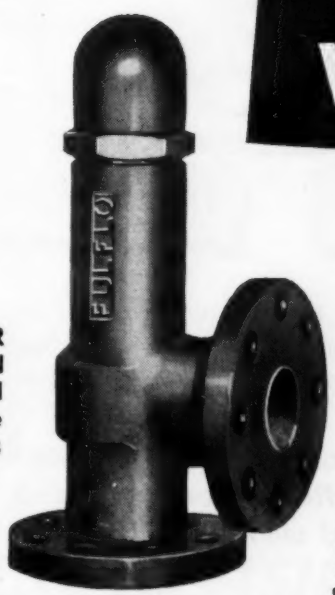

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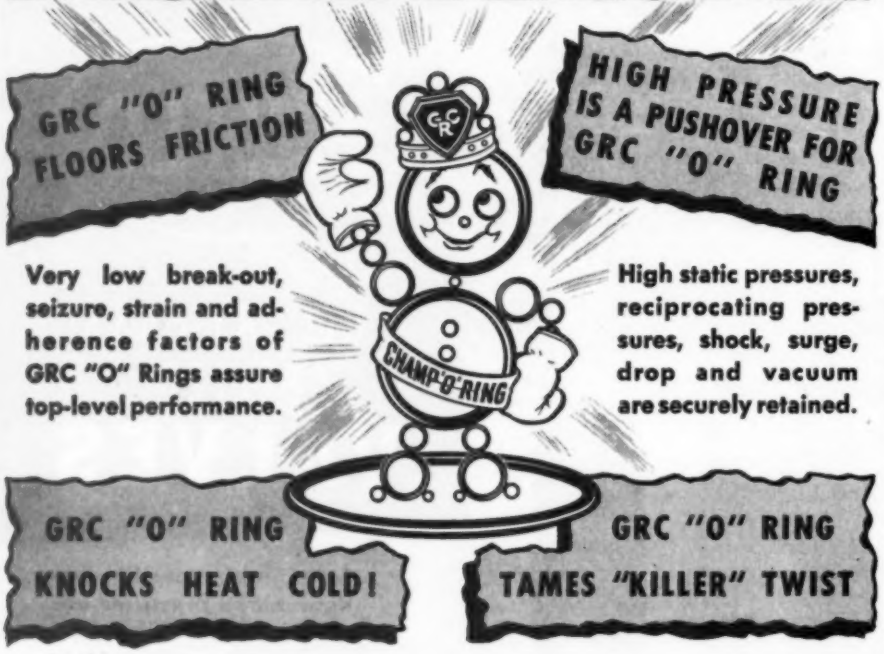
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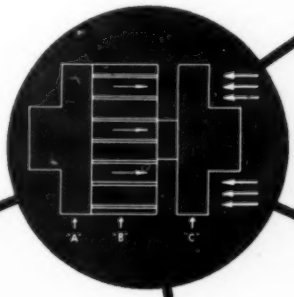

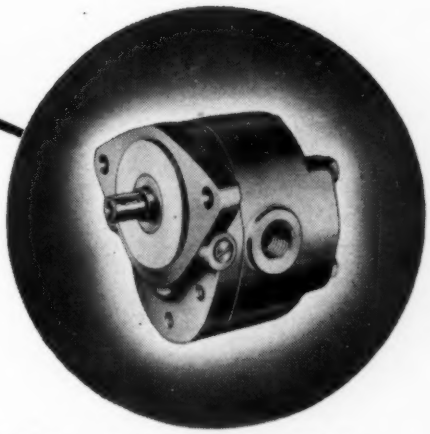

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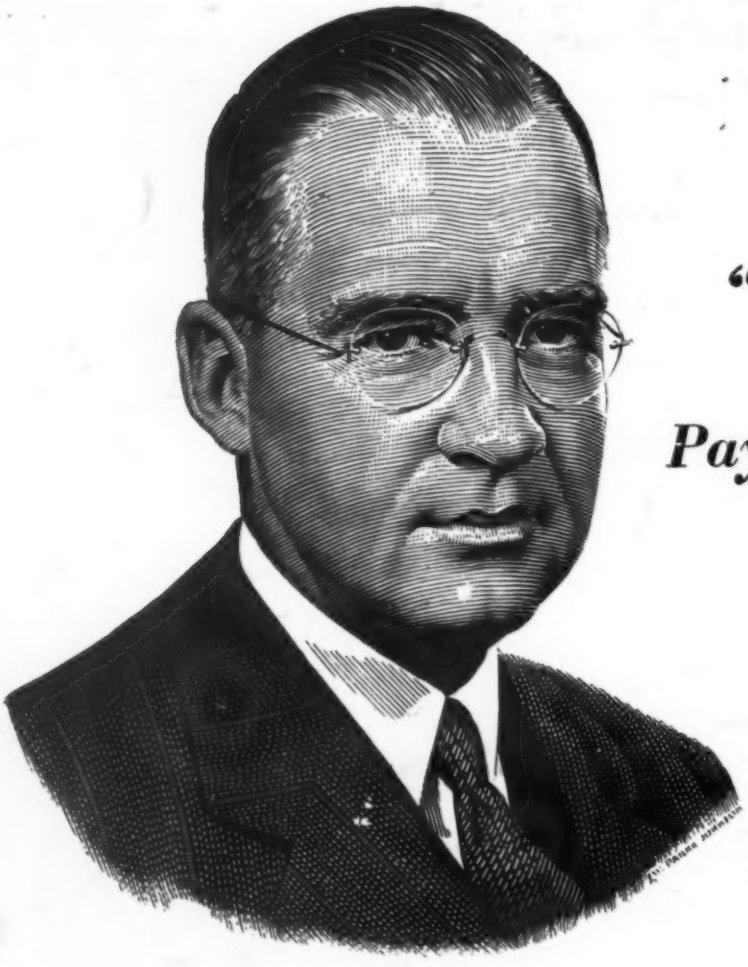

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